Purchasing Contracts Management System

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TABLE OF CONTENTS

Chapter 1 – Vision Document 6
1. Introduction 6
2. Project Overview 6
2.1 Introduction 6
2.1.1 Administrator Module..... 7
2.1.2 User Module..... 7
2.2 Goal 9
2.3 Purpose 9
3. Requirements Specification..... 9
3.1 Primary Requirements 9
3.2 External Interfaces Requirements 10
3.3 Critical Use Case Requirements 10
3.4 Assumptions 14
3.5 Environment 14

Chapter 2 – Project Plan 15
1. Task Breakdown 15
1.1 Inception Phase 15
1.2 Elaboration Phase 15
1.3 Production Phase 16
2. Architecture Elaboration Plan 19
2.1 Revision of Vision Document 20
2.2 Revision of Project Plan 20
2.3 Architecture Design.....20
2.4 Prototype Development.....20
2.5 Test Plan 20
2.6 Formal Technical Inspections 20
2.7 Formal Requirements Specification 20
3. Cost Estimate.....21
3.1. COCOMO Model.....21
3.2. GANTT Chart.....21
4. Implementation 22
4.1 Deliverables 22
4.2 Work Breakdown Structure 22

Chapter 3 – Architecture Design 25
1. Introduction 25
2. Architecture of the System 25
2.1 Presentation Tier 26
2.2 Business-Tier 26
3. Formal Specification 33

Chapter 4 – Inspection List 42
1. Purpose 42

2. Items to be Inspected 42

Chapter 5 – Component Design 44
1. Introduction 44
2. Class Description and Diagrams 44

Chapter 6 – Software Quality Assurance Plan 50
1. Purpose 50
2. Reference Documents 50
3. Management 50
3.1 Organization 50
3.2 Responsibilities 50
3.3 Tasks..... 51
4. Documentation 51
5. Standards, Practices, Conventions, and Metrics 52
6. Reviews and Audits 52
7. Test 52
8. Problem Reporting.....52
9. Deliverales.....53

Chapter 7 – Test Plan 55
1. Introduction 55
2. Features to be tested 55
3 Test Cases
3.1 Test Cases for Administrator Requirements..... 56
3.2 Test cases for User Requirements 60
4. Approach..... 62
4.1 Unit Testing 62
4.2 Performance Testing 62
5. Item Pass/Fail Criteria 63
6. Suspension Criteria and Resumption Requirements 63
6.1 Suspension Criteria 63
6.2 Resumption Requirement 63
7. Test Deliverables 63
8. Environmental Needs 64
8.1 Software 64
8.2 Operating System 64

Chapter 8 – Assessment Evaluation 65
1. Introduction 65
2. Test Case Result Summary 65
3. Detailed Test Results 65
3.1 Manual Testing 65
3.2 Unit Testing 68
3.3 Performance Testing 75
4. Scalability 81

Chapter 9 – User Manual 82
1. Introduction 82
2. Installation and Set-up 82
2.1 Required Hardware 82
2.2 Required Software 82
2.3 Required Network Configuration 83
2.4 Software Setup 83
3. Purchasing Contracts Management System Usage 84

Chapter 10 – Project Evaluation..... 94
1. Introduction 94
2. Problems Encountered.....94
2.1 Identification of technology to be used 94
2.2 Features to implement 94
3. Source Lines of Code 94
4. Project Duration 95
5. Lessons Learnt 98
References 99

LIST OF TABLES

Table 1 - The Work Breakdown Structure Table 24

Table 2 - Client Site ASP.NET Web Forms 26

Table 3 - Administrator Site ASP.NET Web Forms……..... 26

Table 4 - Database Table 33

Table 5 - Formal Technical Inspection List..... 43

Table 6 - Features to be Tested 55

Table 7 - Test Case Result Summary 76

Table 8 - Test 2 Results Summary……. 80

Table 9 - Project Duration……. .96

Chapter 1 – Vision Document

1. Introduction

1.1. Purpose and Motivation

The objective of this project is to implement a purchasing contracts management system. The motivation of this project comes from my desire to learn and explore the growing field of .NET technologies, AJAX that is gaining immense popularity in recent times and SQL server database designing. The project is being developed for the 'Division of Financial Services' at Kansas State University. The system under consideration provides a more functional, usable and secure solution for handling purchasing contracts information.

Although web designing in the broader context might refer to the visual and user interface design of a system, the usability of a system gains a lot more importance when talking about holding the attention of a user in a website. If the site is hard to use or the information is not presented to the user in a clear and concise way it is quite natural for users to not use the website. Hence the design of the website should be created keeping in mind the target audience.

Scalability of a system is one of the most important features that need to be kept in mind while designing and implementing the system. The system must be designed so as to handle growing amounts of work in a graceful manner. Thus the primary motivation of the project is to build a functional, scalable and a reliable system.

2. Project Overview

2.1 Introduction

The purchasing contracts management system is a system that should be able to allow a procurement officer to insert new contracts into the system. Already existing contracts might be renewed and under such situations, data already present such as expiration date etc might have to be updated. Thus it is vital for the system to be able to allow updating existing information.

Purchasing contracts might belong to one of four categories – those that require

a) No pre-approval b) Human Resources Approval c) Telecom Approval d) Facilities Approval. This information must be available to the end user of the system. The primary focus of the system is to ensure that information on the purchasing contracts is available to the end users easily. Hence the graphical user interface must be designed in such a manner that it achieves the single most important thing any GUI must accomplish, user friendliness.

The application is implemented using VB and ASP.NET. The application can be divided into two modules.

2.1.1 Administrator Module:

The procurement officer who plays the role of an administrator in our system is the only authority who can insert or update contract details. Thus the pages that are accessible by the administrator must be secure and only a valid administrator should be allowed to access these secure pages.

This module covers the following implementations:

- ***Adding new contract details***

If a new contract detail is to be inserted, one of the basic checks that need to be implemented in the system is that the contract should not have existed in the system previously.

- ***Update existing contract details***

The update page will include the search functionality, since it is more user-friendly to search for contracts in the system and then further update them. Once the contracts are obtained, the update functionality is very similar to that of insert, wherein the new values are replaced with older values.

2.1.2 User Module:

The end users of the system are those who access the system with intent of finding details about contracts. This might be a department which is trying to purchase goods with the contract vendors or the telecom, human resources, facilities departments that might want to view those contracts details that require their approval.

Thus the user module covers the following implementations:

- ***Searching for contract details***

With respect to the user interface, the user can search for contracts based on the contract number, title, vendor name, department name or any other keywords. On the other hand, users who are not sure about the contract number can request to display all the contracts and further filter the results by department name or vendor name or the department from which approval is required. All users must be allowed to view contract details and so this page is not an authenticated webpage.

The diagram below captures the page flow model for the administrator and the user:

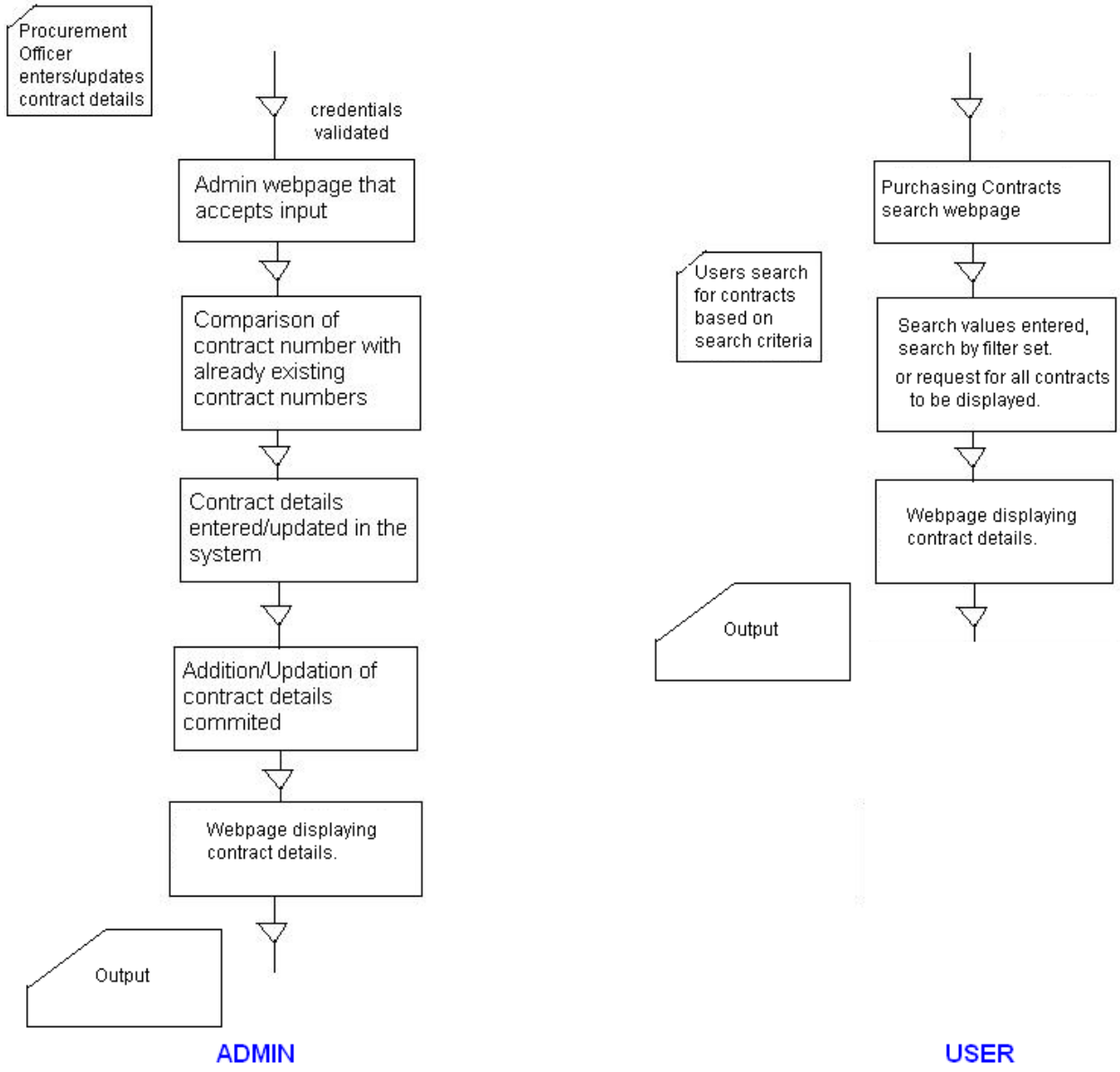

Procurement Officer enters/updates contract details
credentials validated
Admin webpage that accepts input
Comparison of contract number with already existing contract numbers
Contract details entered/updated in the system
Addition/Updation of contract details commited
Webpage displaying contract details.
Output
ADMIN
Users search for contracts based on search criteria
Purchasing Contracts search webpage
Search values entered, search by filter set.
or request for all contracts to be displayed.
Webpage displaying contract details.
Output
USER

Figure 1: Page Flow Diagram

The system under consideration will interact as follows:

a. The client sends request and .NET form inputs over the network.

b. The Internet Information Server (IIS) receives .Net form inputs.

c. IIS Web server

i. Processes inputs

ii. If required, queries to the database and retrieves data

d. The IIS Web server sends back processed output over the network as a Web page.

e. The client receives the output as a Web page.

2.2. Goal

The goal of this project is to provide an automated .NET Web application that allows a procurement officer to insert and update contract details and one that allows all users to view details of a contract in a fast and efficient manner instead of browsing through an excel document to find contract details.

2.3. Purpose

The purpose of this project is to explore the capabilities of the Microsoft .NET framework, the Ajax toolkit and provide a convenient service to add or update contracts. The system is also intended to retrieve contract details in a fast and efficient manner.

3. Requirement Specification

3.1. Primary Requirements

1. Construct a system with three-tier architecture. Figure 3 shows the system on three tier architecture.

2. Microsoft Visual Studio 2005, ASP.NET, VB language, Microsoft SQL Server 2005

3. Ajax will be used on client side to make the application user interactive.

4. The final product will be run on Internet Information Server (IIS).

5. Mozilla Firefox will be used as a main browser.

3.2. External Interface Requirements

All user interfaces are ASP.NET-generated Web pages. In order to access the system, the user will need to use a workstation with Internet accessibility equipped with Internet Explorer. It is also a must that the Microsoft .NET Framework is installed and a broadband connection is recommended to boost the performance. The Administrator can add new or update the contract details of existing contracts. The end user can browse/search through the list of contracts and get details of the contract such the prior approval required from any department.

3.3. Critical Use Case Requirements

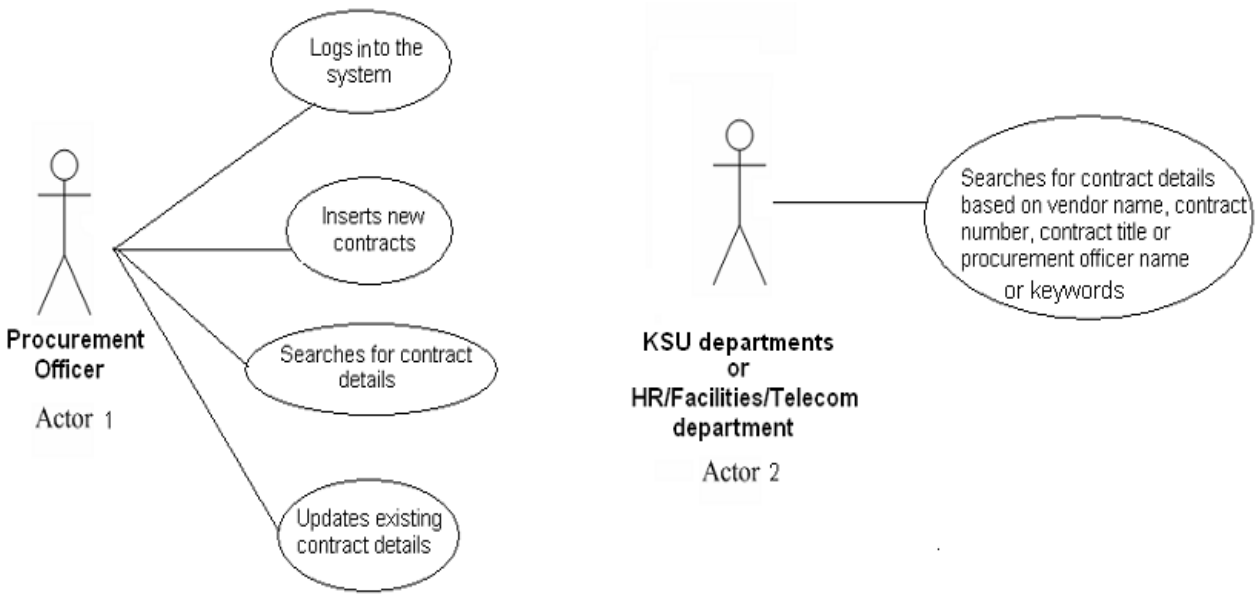

Logs into the system
Inserts new contracts
Searches for contract details
Updates existing contract details
Procurement Officer
Actor 1
Searches for contract details based on vendor name, contract number, contract title or procurement officer name or keywords
KSU departments or HR/Facilities/Telecom department
Actor 2

Figure 2 : Use Case Diagram

There are two actors for a purchasing contracts management system – an administrator and a customer.

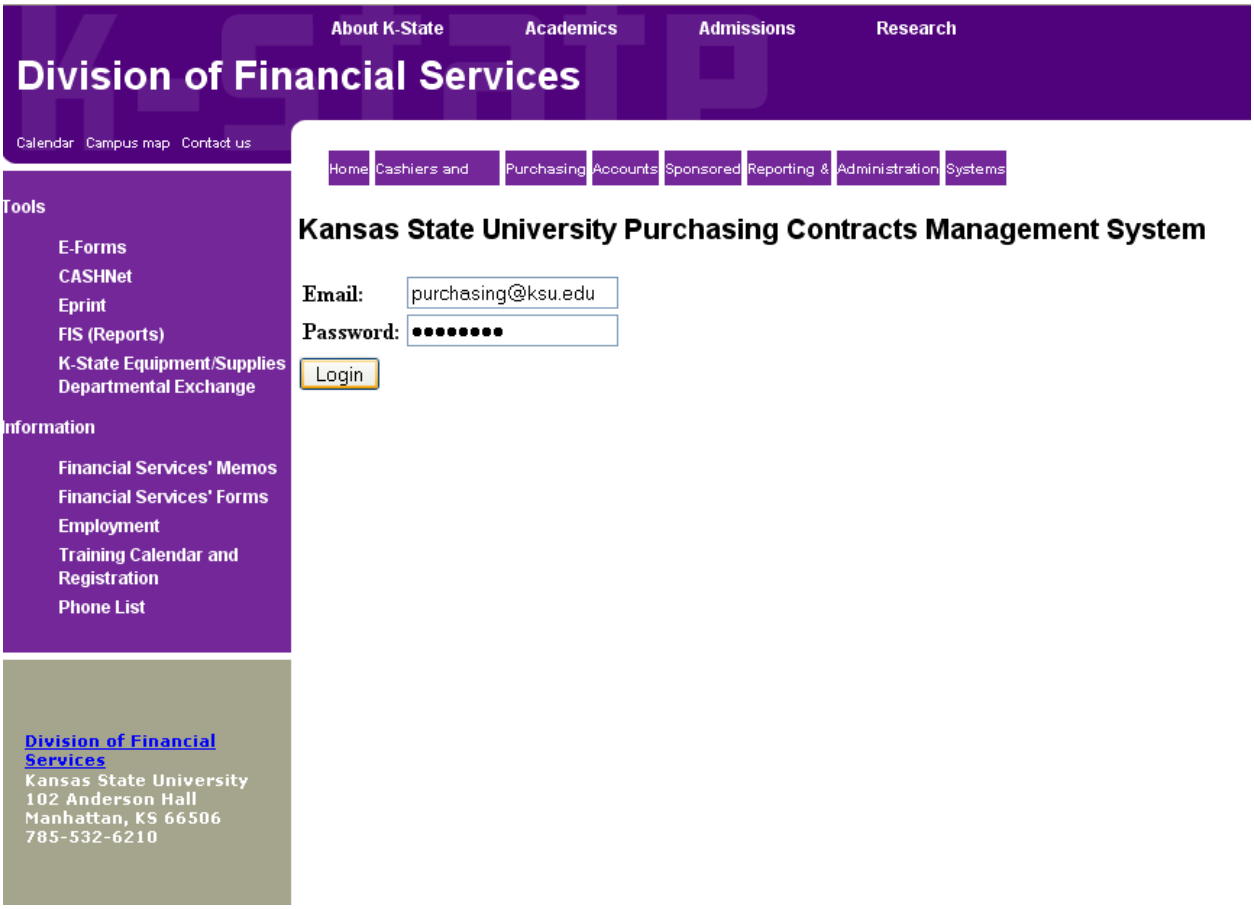
An administrator uses the system under the following scenarios:

- Login to the system
- Add new contracts
- Update existing contracts

- Search for contract details

Use Case 1: Login to the system

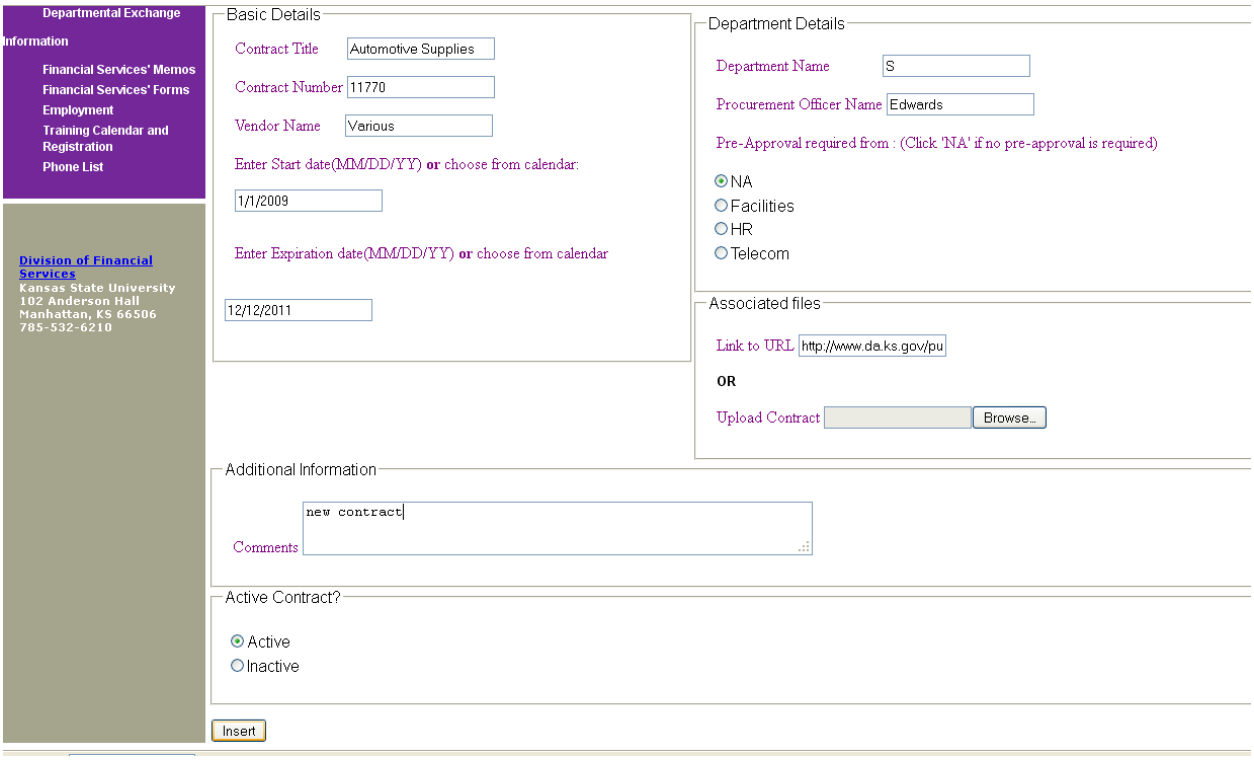
- ❖ **Purpose :** The administrator needs to login to the system in order to add new contract or update existing contracts in the system.
- ❖ **Input :** The administrator will enter the email ID and password combination.
- ❖ **Output :** If the administrator has entered a valid email, password combination he is allowed access to the secure webpages. If the email password combination is incorrect a message "" is displayed to the administrator.



Use Case 2: Add new contracts to the system

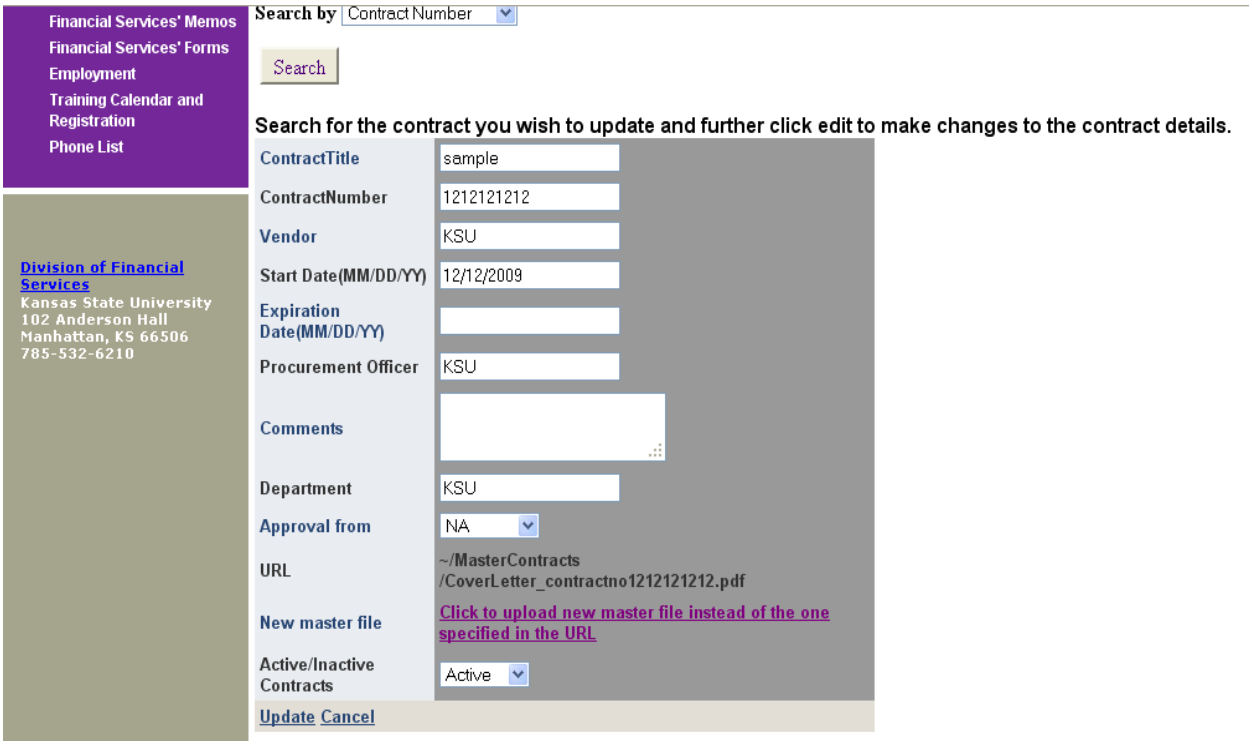
- ❖ **Purpose :** To add new contract details to the system.
- ❖ **Precondition** : Administrator must be logged in to be able to create and add a new contracts to the system. Also, the contract number that is to be added should not exist in the system previously.

- **Input :** The administrator will enter the contract number, contract title, vendor name, procurement officer name and the department name and click the "Insert" button to complete the action.
- **Output :** On completion of the insert action the new details will be added to the system and a "Insert Successful" message will be displayed to the user.



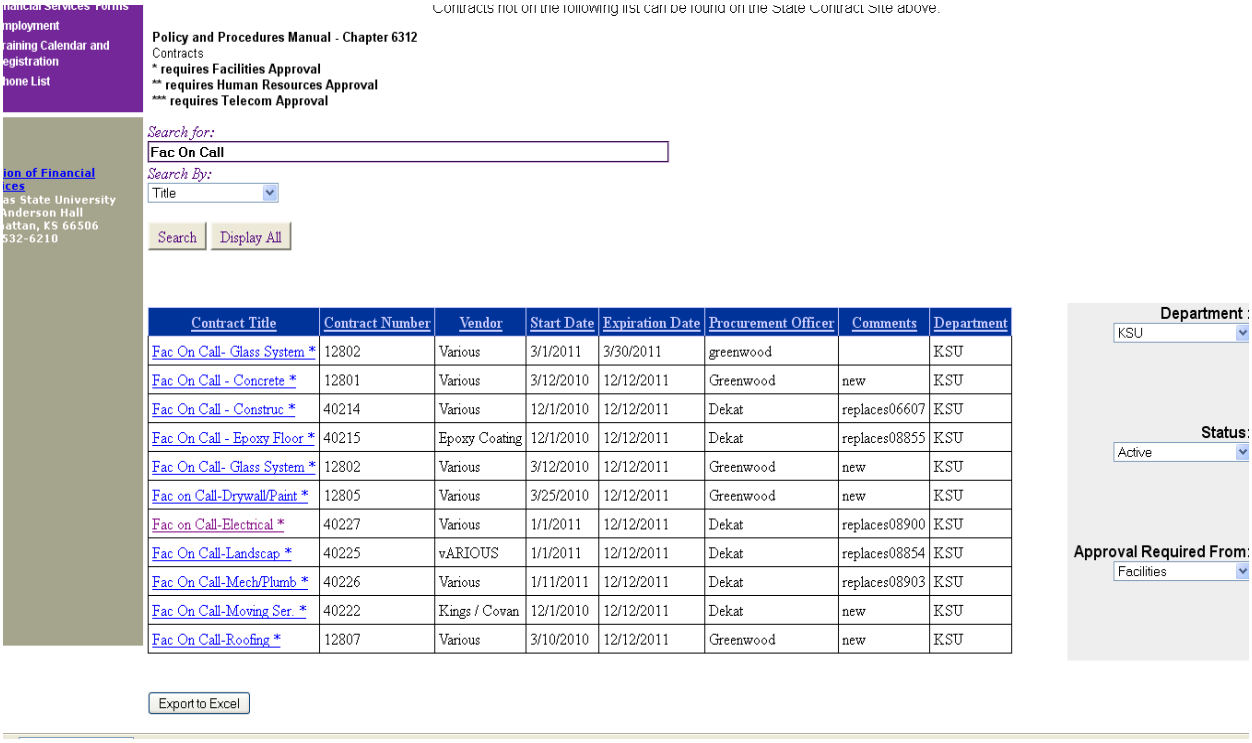
Use Case 3 : Update existing contracts

- **Purpose:** To update details of already existing contracts
- **Precondition :** Administrator must be logged in to be able to create and add a new contracts to the system. Also, the contract number that is to be added should exist in the system previously.
- **Input:** The administrator may enter new values for the contract title and/or vendor and/or start date etc and click the "Update" button to complete the action.
- **Output:** On completion of the update action the new details will replace the existing details in the system.



Use Case 4: Search contract details:

- **Purpose:** The purpose of this use case is to enable the customer to find the details of an available contract without having to browse the entire contracts set.
- **Input:** The user enters a valid search criteria in the search page, sets the search filter to an appropriate value and clicks on the search button.
- **Output :** When the user enters a valid search criteria in the search page, sets the search filter to an appropriate value and clicks on the search button all the contracts pertaining to the search criteria are retrieved. Sometimes a number of records may be retrieved that matches the particular search entered and hence these records may further be filtered by setting the filter on the right side of the search page based on a particular department and/or a vendor and/or the department from which prior approval is required.


Contracts not on the following list can be found on the State Contract Site above.
Policy and Procedures Manual - Chapter 6312
Contracts
* requires Facilities Approval
** requires Human Resources Approval
*** requires Telecom Approval
Search for:
Fac On Call
Search By:
Title
Search
Display All
Contract Title
Contract Number
Vendor
Start Date
Expiration Date
Procurement Officer
Comments
Department
Fac On Call- Glass System * 12802 Various 3/1/2011 3/30/2011 greenwood KSU
Fac On Call - Concrete * 12801 Various 3/12/2010 12/12/2011 Greenwood new KSU
Fac On Call - Construc * 40214 Various 12/1/2010 12/12/2011 Dekat replaces06607 KSU
Fac On Call - Epoxy Floor * 40215 Epoxy Coating 12/1/2010 12/12/2011 Dekat replaces08855 KSU
Fac On Call- Glass System * 12802 Various 3/12/2010 12/12/2011 Greenwood new KSU
Fac on Call-Drywall/Paint * 12805 Various 3/25/2010 12/12/2011 Greenwood new KSU
Fac on Call-Electrical * 40227 Various 1/1/2011 12/12/2011 Dekat replaces08900 KSU
Fac On Call-Landscap * 40225 vARIOUS 1/1/2011 12/12/2011 Dekat replaces08854 KSU
Fac On Call-Mech/Plumb * 40226 Various 1/11/2011 12/12/2011 Dekat replaces08903 KSU
Fac On Call-Moving Ser. * 40222 Kings / Covan 12/1/2010 12/12/2011 Dekat new KSU
Fac On Call-Roofing * 12807 Various 3/10/2010 12/12/2011 Greenwood new KSU
Department
KSU
Status
Active
Approval Required From
Facilities
Export to Excel

3.4. Assumptions

- The user will interact with the system using a webpage.
- The user will have internet connection whenever he/she is using the Purchasing Contracts Management website.
- In order to view and interact with the webpage the user must have an active (if possible high-speed) internet connection.
- The user will need a minimum of 512 MB of memory.

3.5. Environment

- The application is programmed in Visual Basic and runs on Microsoft .NET platform.
- CSS is used to design the look of the webpage.
- The Purchasing contracts management system will be tested on Windows XP platform.

Chapter 2 – Project Plan

1. Task Breakdown

1.1.Inception Phase

The primary objective in the inception phase is to achieve concurrence among all stakeholders. Since the system under consideration is a new development effort and not an enhancement to an already existing system, the inception phase needs to be more detailed addressing the requirements before the project can proceed. At the end of the inception phase we hope to establish the scope and boundary of the project including the vision and the project plan. Hence the deliverables at the end of this phase include:

The vision document that will include an overview of the project, its purpose, goals, risks, constraints, and direction. It will also discuss the main product features, quality attributes, and external interfaces. It will also include the critical project requirements and the major use cases will be defined and elaborated in the requirements analysis.

The project plan document that will describe the work to be accomplished in each phase as well as the inclusion of an estimate of the workload of the project that will establish a schedule for the completion of all project activities.

The software quality assurance plan that defines the techniques, procedures, and methodologies that will be used to assure timely delivery of the software that meets the specified requirements within project resources.

An executable prototype of the user interface will be demonstrated in Presentation I to establish the feasibility of the important elements of the use case requirements. This will be a milestone for the inception phase.

1.2.Elaboration Phase

In this phase the architectural plan of the system is being developed and the requirement model must evolve to a 80% completion point. The high-priority risks associated with the project must be understood and the deliverables for this phase include the Formal Requirement Specification, the Architecture Design and an executable prototype that will address all critical requirements mentioned in the vision document.

On completion of the first presentation the suggestions that were provided by the supervisory committee should be included while developing the second prototype.

1.3.Production Phase

The production phase is concentrated on the implementation design requirements, deployment and testing of the system. In this phase, the developer will construct the code and ensure that it is well documented. The code will be tested entirely to guarantee that all requirements are met. All test results will be analyzed and documented. A user manual will also be produced by the developer, which will describe how to install, run, and use the tool efficiently.

At the conclusion of this phase, the developer will present the final version of the software product as the final presentation as well as submit all the required documentation. Review and approval of final presentation determines the completion of project.

The Constructive Cost Model (COCOMO) is one of the most popular software cost estimation models. COCOMO II takes into account four cost drivers, each with a number of subsidiary attributes. The cost drivers are Product, Hardware, Personnel and Project attributes.

Each of these receives a rating from "very low" to "high". The following table describes the effort multiplier that is applied to the rating. The product of all effort multipliers results in an effort adjustment factor (EAF).

The table below lists all the adjustment factors and their corresponding ranges.

Cost Drivers	**Very low**	**Low**	**Nominal**	**High**	**Very High**	**Extra High**
Product attributes						
Required software reliability	0.75	0.88	1.00	1.15	1.40	
Size of application database		0.94	1.00	1.08	1.16	
Complexity of the product	0.70	0.85	1.00	1.15	1.30	1.65
Hardware attributes						
Run-time performance constraints			1.00	1.11	1.30	1.66

Memory constraints			1.00	1.06	1.21	1.56
Volatility of the virtual machine environment		0.87	1.00	1.15	1.30	
Required turnabout time		0.87	1.00	1.07	1.15	
Personnel attributes						
Analyst capability	1.46	1.19	1.00	0.86	0.71	
Applications experience	1.29	1.13	1.00	0.91	0.82	
Software engineer capability	1.42	1.17	1.00	0.86	0.70	
Virtual machine experience	1.21	1.10	1.00	0.90		
Programming language experience	1.14	1.07	1.00	0.95		
Project attributes						
Application of software engineering methods	1.24	1.10	1.00	0.91	0.82	
Use of software tools	1.24	1.10	1.00	0.91	0.83	
Required development schedule	1.23	1.08	1.00	1.10	1.10	

For our KSU-Purchasing Contracts management system, the following will be values and the reason for the same is also mentioned under comments.

Cost Drivers	**Category**	**Value**	**Comments**
Product attributes			

Required software reliability	Low	0.88	Reliability is the probability of failure-free operation of a computer program in a specified environment for a specified time. Application is not very critical and hence the value can be low.
Size of application database	Nominal	1.00	Users input, contract details that need to be stored in the db.
Complexity of the product	Nominal	1.00	Web application that follows the 3 tier architecture. **Request:** Client Browser -> Server -> DB **Response:** DB->Server ->Browser
Hardware attributes			
Run-time performance constraints	Nominal	1.00	Important but not critical
Memory constraints	Nominal	1.00	Not require high memory usage
Volatility of the virtual machine environment	Low	0.87	
Required turnabout time	Low	0.87	
Personnel attributes			
Analyst capability	High	0.86	Developer has been involved in projects earlier.
Applications experience	Nominal	1.00	Nominal experience in developing applications

Software engineer capability	Nominal	1.00	
Virtual machine experience	Low	1.10	
Programming language experience	Nominal	1.00	6 months experience in developing .NET applications
Project attributes			
Application of software engineering methods	Nominal	1.00	
Use of software tools	Nominal	0.83	Style sheet editors, text editors
Required development schedule	Nominal	1.00	

Thus in our scenario the EAF is 0.523

In the second phase I estimated the total size of the project to be around 2200 LOC based on the current prototype and similar examples.

Total estimated SLOC for the entire project = 2200 SLOC

$$\text{Effort} = 2.45 * \text{EAF} * (\text{KSLOC})^{1.09}$$

$$\text{Time} = 2.5 * (\text{Effort})^{0.38}$$

Where:

Effort = the number of person months (PM)

Time = Duration time in months for project

KSLOC = Estimated number of source lines of code for the project (Expressed in thousands)

EAF = Effort Adjustment Factor

Applying the above formula for our KSU – Purchasing contracts management system we can calculate the effort and time required to complete the project.

$$\text{Effort} = 2.45 * 0.523 * (2.2)^{1.09} = 3.04 \text{ man-months}$$

$$\text{Time} = 2.5 * (\text{Effort})^{0.38} = 3.8 \text{ months}$$

Thus it is estimated that it will take 3.04 man months to complete the project. The time that is calculated should take around 3.8 months to complete it.

2. Architecture Elaboration Plan:

The following are the list of documents that need to be complete and submitted before the second presentation:

2.1. Vision Document Revision

The vision document that was submitted in the first presentation needs to be reviewed and revised such that it includes all the suggestions that were made by the supervisory committee. The requirements are all ordered by priority and further submitted to the committee for approval.

2.2. Project Plan Revision

Like the vision document the project plan document is also revised including suggestions made in the first presentation. This further means that based on the changes, the Gantt chart and the COCOMO estimates are all updated and further submitted to the committee for approval.

2.3. Architectural Design

The Architectural Design document explains the components and the scenarios of the system under consideration with the help of UML diagrams which is further submitted to the committee for approval.

2.4. Prototype Development

As part of the first presentation, a prototype is developed and submitted to the supervisory committee. More features are added to this prototype and an enhanced version with new functionalities added will be part of the second presentation.

2.5. Test Plan

The test plan is a document that describes the test conditions, data, and coverage of a particular test or group of tests. Based on the vision document a test plan outlining all instructions about evaluating a product will be submitted to the committee.

2.6. Formal Technical Inspections

The technical inspectors will use a formal inspection checklist that will be produced during the Elaboration phase. The technical inspectors are Srunokshi Neelkantan.and Krishnaveena Ramavat

2.7. Formal Requirements Specification

Object Constraint Language (OCL) is a declarative language for describing rules that apply to Unified Modeling Language (UML) models. OCL will be used to specify one of the modules with the help of the USE tool.

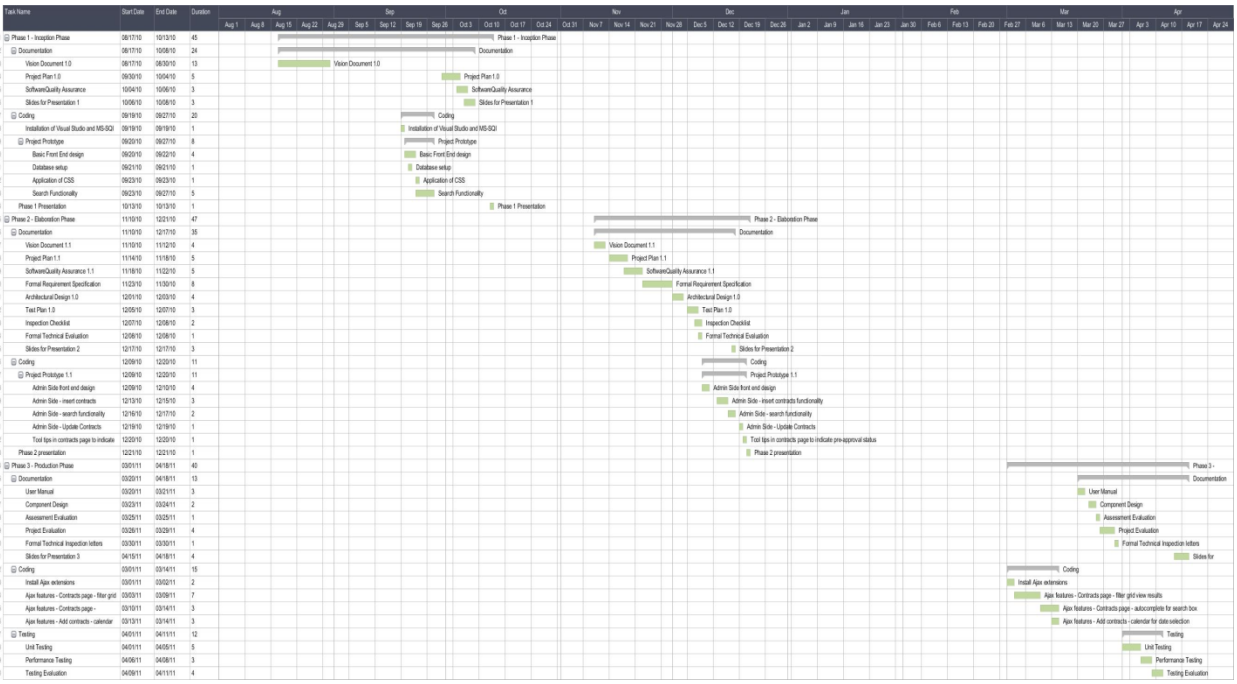
3. Cost Estimate

3.1. COCOMO Model

In 1981, Barry Boehm designed "COnstructive COst MOdel" to give an estimate of the number of person-months it will take to develop a software product. The model also estimates the development schedule in months and produces an effort and schedule distribution by major phases. The model estimates cost using one of three different development modes: organic, semidetached and embedded. Organic projects - are relatively small, simple software projects in which small teams with good application experience work to a set of less than rigid requirements. Semi-detached projects - are intermediate (in size and complexity) software projects in which teams with mixed experience levels must meet a mix of rigid and less than rigid requirements. Embedded projects - are software projects that must be developed within a set of tight hardware, software, and operational constraints.

The Effort Adjustment Factor is the product of the 15 adjustment parameters. Each of the 15 attributes receives a rating on a 6-point scale that ranges from "very low" to "extra high" (in importance or value). An effort multiplier from the table below applies to the rating. The product of all effort multipliers results in an 'effort adjustment factor (EAF). Typical values for EAF range from 0.9 to 1.4.

3.2. GANTT Chart



4. Implementation Plan

4.1. Deliverables

The following are the deliverables for Presentation III:

Source Code

Well-documented source code will be submitted. This code will correspond directly to the architecture and component design.

Assessment Evaluation

Test cases that were identified in the Test Plan will be executed. Defect fixing will be done for all resolvable issues. All test results will be documented. The documentation will include a document detailing the testing done on the project along with the descriptions of the testing and known unresolved defects.

User Manual

The user manual will include an installation guide and a user guide. The installation guide will include detailed information on how to set up the software, while the user guide will give detailed explanations of common usage and user commands.

Component Design

The internal design of each component will be documented. UML diagrams will be used for the said design.

Project Evaluation

The entire software process starting from the first phase will be reviewed. This will include the usefulness of the methodologies used, the accuracy of the estimations, and the usefulness of the reviews. The tool will be reviewed and evaluated to check whether it accomplishes the goals presented in the vision document and if the quality of the product is achieved.

Formal Technical Inspection Letters

The two MSE students will perform the technical inspection of the architecture design. They will submit a formal letter stating that the project has successfully passed all technical requirements.

References

The annotated bibliography will include cited references for all notations used in the portfolio.

4.2. Work Breakdown Structure

The following table breaks down the deliverables into tasks and lists the completion criteria and cost for each task.

Deliverable	Tasks	Completion Criterion	Cost
Source Code	Ajax features – User page, filter contracts in grid.	Executable code	5 days
	Ajax features – calendar in Add contracts page	Executable code	2 days
	Ajax features – Auto complete for users search contract page.	Executable code	2 days
	Export the contract search results to an excel document	Executable code	2 days
Assessment Evaluation and Testing	Run test cases and fix resolvable issues	All test cases complete	5 days
	Run Performance testing using Jmeter	All test cases complete	4 days
	Document test results	All the test case results evaluated and documented	3 days
User Manual	User Guide	Approved by Major Professor	3 days
Component Design	Document Purchasing contract management system design	All major features of the Purchasing contract management system are documented with UML	2 days
Project	Document usefulness of project, methodologies,	Approved by Major Professor	2 days

Evaluation	practices, and reviews		
	Compile all project resources together	Approved by Major Professor	2 days
Formal Technical Inspection Letters	Receive letters from formal technical inspectors	Approved by Major Professor	1 day
References	All references documented	Approved by Major Professor	1 day

Table 1 : Work Breakdown Structure Table

Chapter 3 – Architecture Design

1. Introduction

The primary purpose of this document is to provide an architectural design for the purchasing contracts management system. The design will show the presentation tier, the business tier that composes the class and sequence diagrams, and the data tier. Each class will have a brief description about its purpose.

2. Architecture

The following diagram represents the three tier architecture that consists of the presentation tier, the business tier and the data tier. The presentation tier contains the UI (User Interface) elements of the site. This layer is responsible for displaying the contents to the users. The business tier receives requests from the presentation tier and based on the business logic it contains, the result is returned to the presentation tier. When the business tier requests for data, the data tier is responsible for sending the stored application's data.

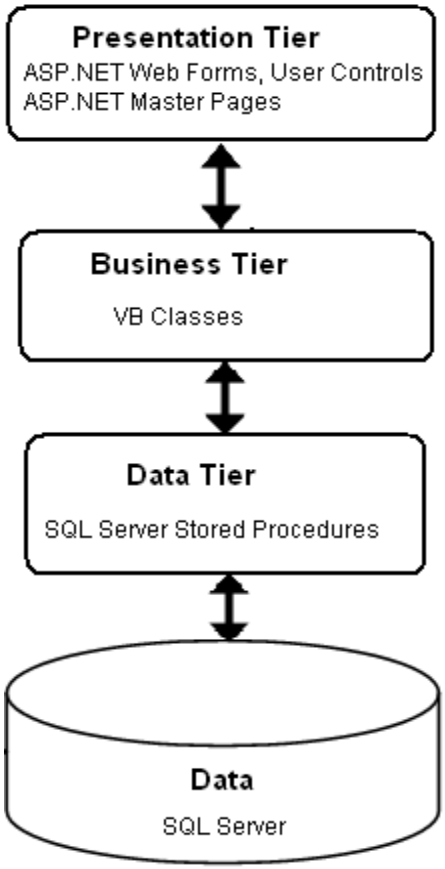


Figure 3 : Three Tier Architecture

2.1. Presentation Tier

The .NET IDE is used in creating web forms that represents the presentation tier for the purchasing contracts management system. The following table represents the ASP.NET web forms for the clients and their respective purpose in the system.

Web Forms	Purpose
Login.aspx	The default welcome page that allows the procurement officer to enter his login credentials.
AddorEdit.aspx	Here the procurement officer decides whether he has to add a new contract or edit an existing contract.
AddContract.aspx	If the procurement officer had decided to add a new contract he is navigated to this page.
UpdateContract.aspx	If the procurement officer had made a choice to update an existing contract this page appears.

Table 2: Administrator Site ASP.NET Web Forms

The following table below shows ASP.NET Web forms for the end user of the system.

Web Forms	Purpose
Contracts.aspx	The default page that contains the search textbox and search filters. On performing a valid search the page contains a grid that populates the search results.

Table 3: Client Site ASP.NET Web Forms

2.2. Business Tier

The business specific layer consists of twelve classes: User, Administrator, Department, KSU Departments, SessionManager, Contracts, SearchFacade, contractSet, Vendor, RecommendationSet, File, Keyword. The diagram below captures the domain model of the Purchasing Contracts Management System.

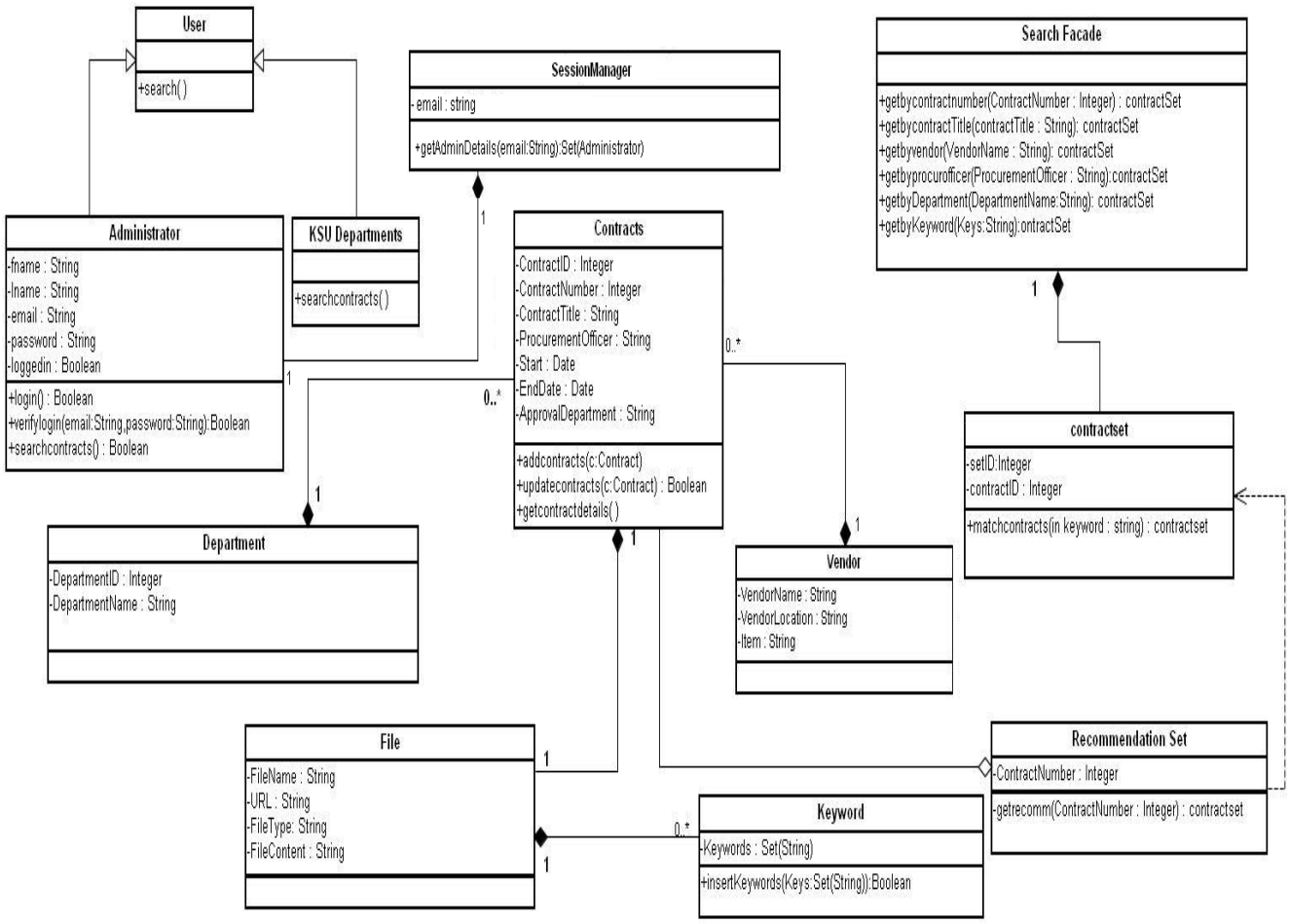


Figure 4 : Domain Model

2.2.1. Class Descriptions

2.2.1.1. Administrator

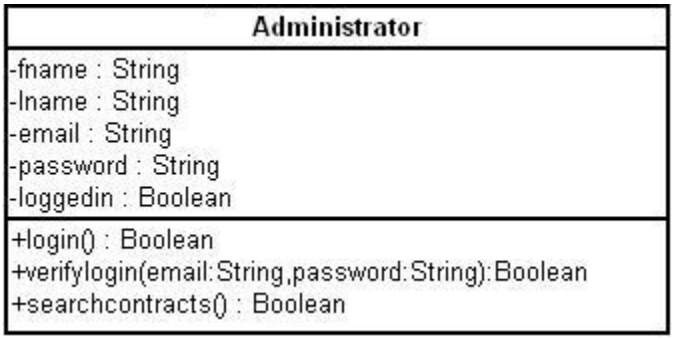


Figure 5 : Administrator Class

This class will handle the actions that are performed by the procurement officer. The procurement officer of the purchasing department plays the role of an administrator in our system. The administrator has an unique email and password that allows them to login to the

system. The class includes methods such as login( ) that is called when the procurement officer logs onto the system. Once the procurement officer enters his valid credentials the verifylogin() method is called that accepts the email and password as its input and returns a Boolean value based on if the login is successful or not. Before performing a change to an existing contract, the searchcontracts( ) method is first called and a search for the contract to be updated is made.

2.2.1.2. KSU Departments

Figure 6 : Administrator Class

The KSU departments class will handle primarily one action of searching for contracts that is indicated by the searchcontracts( ) method. This method will look for contracts in the system based on the contract number/contract title/vendor name/procurement officer/any other keyword.

2.2.1.3. Users

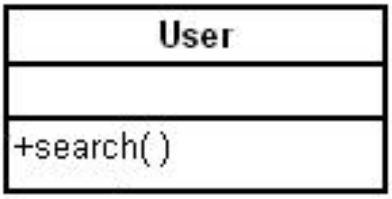


Figure 7 : User Class

This class will handle all user actions. The User class is the super class of the KSU departments class and the Procurement Officer class. It includes a method search() that is used to search for contracts in the system. This method is called when a search field is entered, search filter set and the “search” button I clicked.

2.2.1.4. Session Manager

Figure 8 : Session Manager Class

The session manager class is responsible for maintaining the user information such as the email of the procurement officer for a particular session. The getAdminDetails( ) method is called when the administrator information needs to be displayed.

2.2.1.5. Contracts

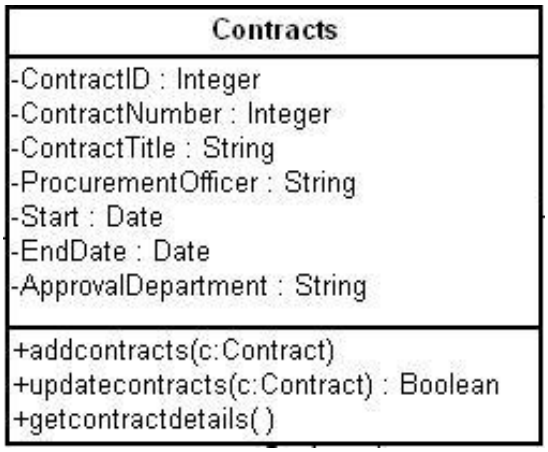


Figure 9 : Contracts Class

This class comprises of contracts with attributes such as the contract number, contract title, procurement officer, vendor name, start date and expiry date, ApprovalRequired, Link etc. The getcontractdetails( ) method is called when the user enters a search criteria and the system retrieves the contract details and the master contract file on click of the contract fields. The addcontracts(c:Contract) is called when the user chooses to add a new contract to the system. This method requires the contract details as an input. On the other hand when the user chooses to update existing contract details, the contract details are taken as an input and the changes are made.

2.2.1.6. Search Facade

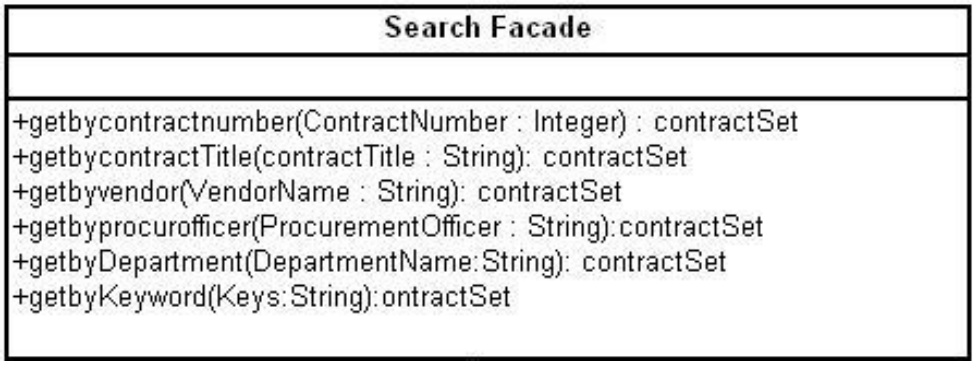


Figure 10 : Search Facade Class

This class primarily contains methods that are used to retrieve the search results based on the options chosen by the user. The getbycontractnumber(contractNumber:int) is called when the user enters search data, sets the search filter to "contract number" and hits the search button. Likewise the getbycontractTitle(contractTitle:string), getbyvendorname(vendorName:string), getbyprocurofficer(procurOfficer:string), getbykeyword(Keys:String) are called when a search criteria is entered and the search filter is set to contractTitle, vendorname, procurement officer and keyword respectively.

2.2.1.7. Keyword

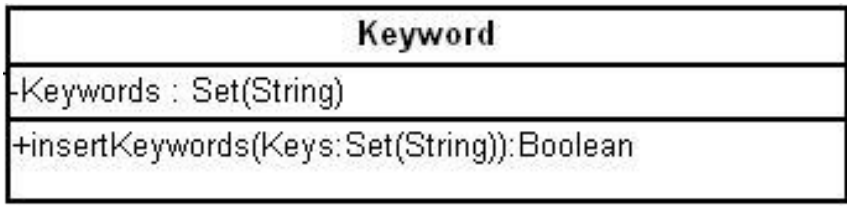


Figure 11 : Keyword Class

The keyword class contains a private method that inserts keywords as a set of strings for the file to be uploaded

2.2.1.8. Recommendation Set

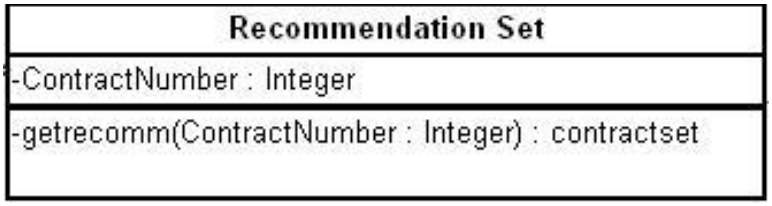


Figure 12 : Recommendation Set Class

When an end user performs a search based on a particular contract number that does not exist in the system, the getrecomm() method is invoked. This method further returns a set of contracts whose contract number is the closest match to the number searched by the user.

2.2.2. Sequence Diagrams

2.2.2.1 Procurement Officer –Login to the system

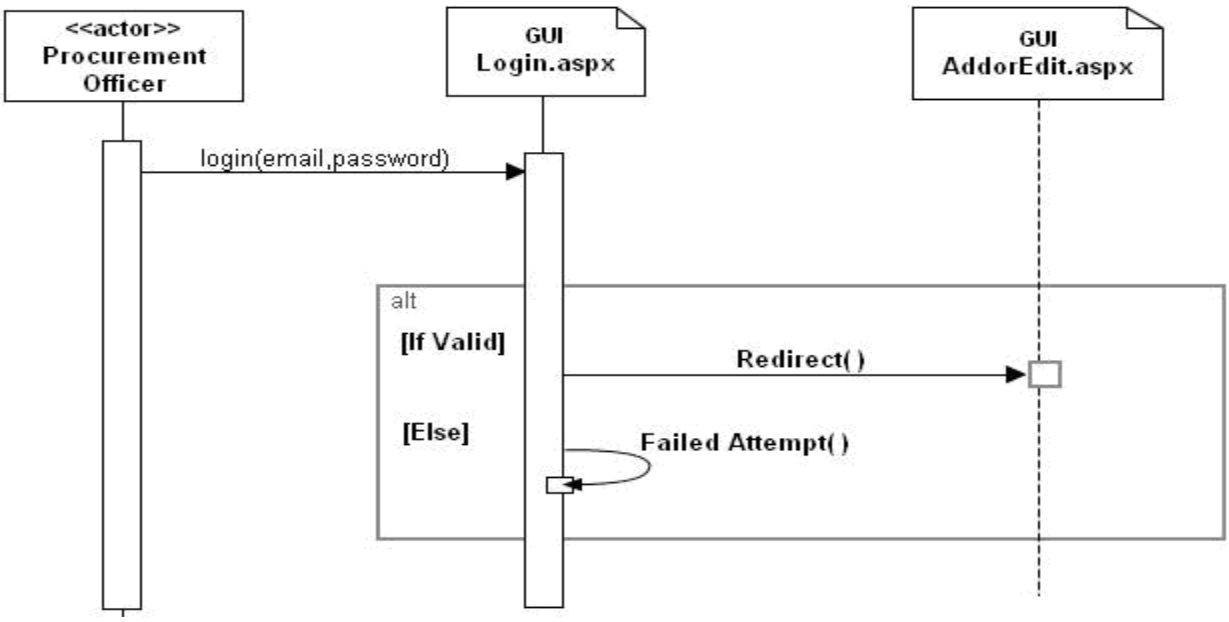


Figure 13: Sequence Diagram - Login to the system

In order to add or edit contracts the procurement officer needs to login to the system. The officer will also enter his/her email and password and logins to the system. On successful login the procurement officer is redirected to the AddorEdit.aspx page where he can perform the desired operation.

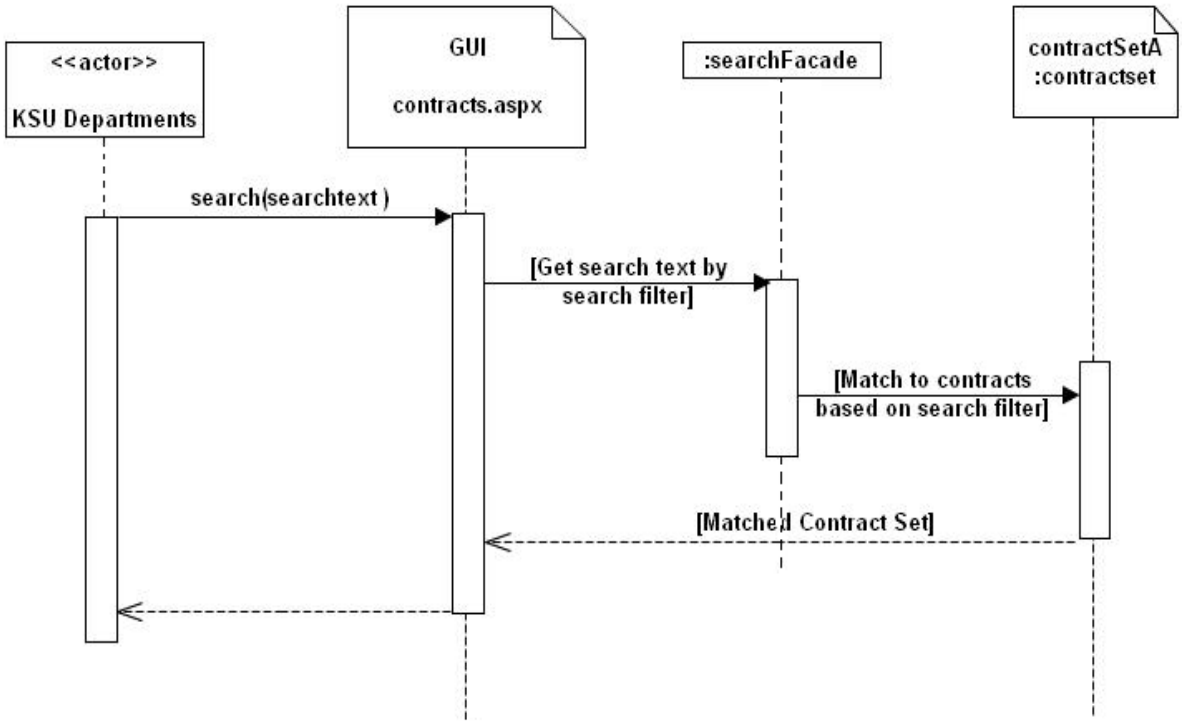


Figure 14: Sequence Diagram - Search for contracts

The above diagram represents the sequence of activities that the KSU departments go through to perform a search for contract details. The search keyword is entered and a search filter is set from 5 categories : contract number, contract title, vendor, procurement officer, keywords. The entered keyword is matched against the contracts table and the matched set is returned back to the user through the contracts.aspx page.

The following diagram represents the sequence of activities that are carried out by the procurement officer in order to insert/edit a contract. The procurement officer enters the contracts details and if the contract number does not exist, the contract is added to the system.

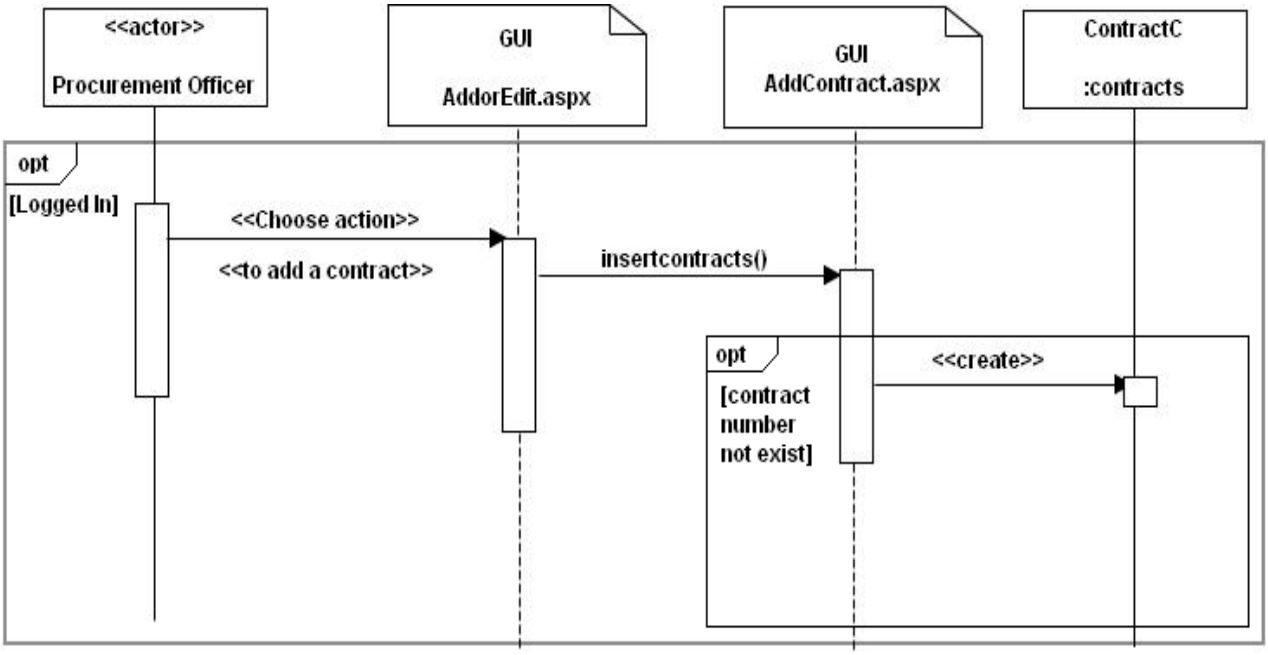


Figure 15: Sequence Diagram - Add contract

The following diagram represents the edit contracts scenario. When the procurement officer chooses to edit an existing contract, the updatecontract() method is called, he first has to search for the required contract number and if the contract exists further edit and save it. If no search results are returned then a message “No results found” is displayed to the user.

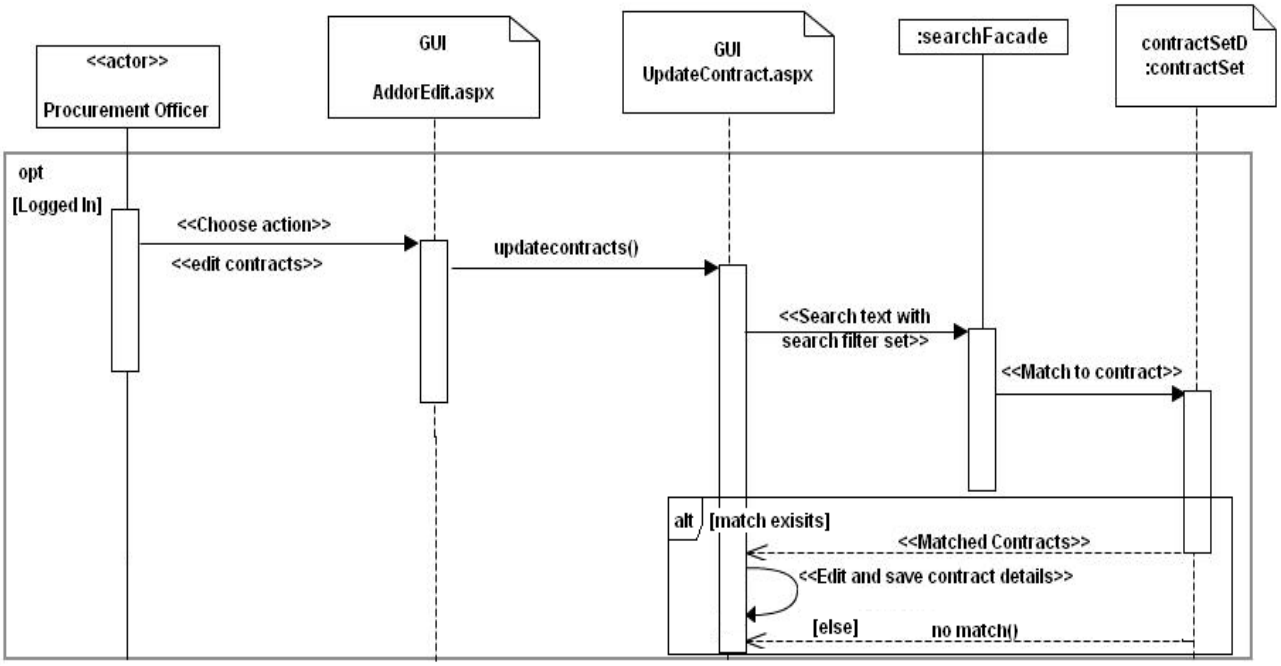


Figure 16: Sequence Diagram - Edit contract

2.2.3. Data Tier

The system database has the following structure of tables:

Table Name	Description
Contracts	Contains the contract related information such as the contract number, contract title, vendor information, procurement officer etc
Departments	Contains the details of the departments such as the department name and department ID that are provide approval for certain contracts.
Administrators	Contain the login details of the administrators.
Vendors	Contain the vendor information such as the vendor name, Item etc

Table 4: Database Table

3. Formal Specification for the system

--

--MODEL

--

model PurchasingContractsManagementSystem

--

-- CLASSES

--

class User

operations

search()

end

class KSUDepartments < User

operations

searchcontracts()

end

class Administrator < User

attributes

fname : String

lname : String

email : String

password: String

loggedin : Boolean

administers : Set(Contract)

operations

login() : Boolean

verifylogin(email:String,password:String):Boolean =

Administrator.allInstances->exists(u:Administrator| u.email = email and u.password = password)

```
  searchcontracts() : Boolean
  end

class Department
attributes
  DepartmentID : Integer
  DepartmentName : String
end

class Vendor
attributes
        VendorName : String
        VendorLocation : String
        Item : String
end

class SessionManager
attributes
  email : String
operations
getProcurementOfficer(email:String):Set(Administrator) =
if Administrator.allInstances->exists(u:Administrator| u.email = email) then
Administrator.allInstances->select(u:Administrator| u.email = email)
else
        oclEmpty(Set(Administrator))
endif
end

class Contract
attributes
  ContractID : Integer
```

ContractNumber : Integer
ContractTitle : String
ProcurementOfficer : String
Start : String
EndDate : String
ApprovalDepartment : String

operations

addContracts(ContractID:Integer,ContractNumber:Integer,ContractTitle:String,ProcurementOfficer:String,Vendor:String,Start:String,End:String,DepartmentName:String,ApprovalRequired:Boolean,ApprovalDepartment:String,Link:Boolean,URL:String)

pre contractpre1: Contract.allInstances.ContractID -> excludes(ContractID)

pre contractpre2: Contract.allInstances.ContractNumber -> excludes(ContractNumber)

post contractpost1: Contract.allInstances.ContractID ->includes(ContractID)

post contractpost2: Contract.allInstances.ContractNumber ->includes(ContractNumber)

updateContracts(ContractID:Integer,ContractNumber:Integer)

pre userpre3: Contract.allInstances.ContractID->includes(ContractID)

post userpost3: Contract.allInstances.ContractID=Contract.allInstances.ContractID@pre

post userpost4:

Contract.allInstances.ContractNumber=Contract.allInstances

->select(c:Contract|c.ContractID<>ContractID).ContractNumber@pre

->including(ContractNumber)

end

class SearchFacade

operations

getallContractsinDepartment(d:Department):Set(Contract)

= Contract.allInstances->select(c:Contract | c.belongstodept = d)

getbyVendor(v:Vendor):Set(Contract) = Contract.allInstances

->select(c:Contract | c.belongsto = v)

getbyContractNumber(ContractNumber:Integer):Set(Contract)

= Contract.allInstances->select(c:Contract | c.ContractNumber
= ContractNumber)
getbyProcurementOfficer(ProcurementOfficer:String):Set(Contract)
= Contract.allInstances->select(c:Contract | c.ProcurementOfficer
= ProcurementOfficer)
getbyKeyword(Keys:String):Set(Contract) = Contract.allInstances
->select(c:Contract | c.ContractTitle = Keys or c.ProcurementOfficer
= Keys or c.associatedwith.contains.Keywords->includes(Keys))
end

class File
attributes
FileName : String
URL : String
FileType: String
FileContent : Set(String)
end

class Keyword
attributes
Keywords : Set(String)
operations
insertKeywords(Keys:Set(String)):Boolean
end

--
--ASSOCIATIONS
--

--Association between contracts and department
association Contractbelongstodept between

```
        Contract[0..*] role contracts
        Department[1] role belongstodept
end

--Association between a file and their keywords(meta-information)
association Filekeyword between
        File[1] role availablein
        Keyword[0..*] role contains
end

--Association between contracts and the master contracts
association Filecontracts between
        File[1] role associatedwith
        Contract[1] role contain
end

--Association between Contracts and the vendors
association VendorsandContract between
        Vendor[1] role belongsto
        Contract[0..*] role owns
end

association SessionManagerandAdmin between
        SessionManager[1] role sessionmanager
        Administrator[1] role containsuser
End

--
--INVARIANTS
--
constraints
```

```
--ProcurementOfficer's email is unique
context Administrator
inv UniqueEmail :
    Administrator.allInstances -> forAll(U1, U2 |U1 <> U2 implies U1.email <> U2.email)


--The Conrtact Number for each Contract must be unique.
context Contract
inv UniqueContractNumber:
Contract.allInstances -> forAll(c1, c2 |c1 <> c2 implies
c1.ContractNumber<>c2.ContractNumber)

--The contract number must be a positive value
context Contract
inv Contractpositive:
self.ContractNumber > 0

--Each contract belongs to exactly one department
context Department
inv ContractbelongstoOneDepartment:
Department.allInstances -> forAll (d1,d2 | d1<>d2 implies d1.contracts-
>intersection(d2.contracts)->isEmpty())

--Each contract belongs to exactly one vendor
context Vendor
inv ContractbelongstoOneVendor:
Vendor.allInstances -> forAll (v1,v2 | v1<>v2 implies v1.owns
->intersection(v2.owns)->isEmpty())

--Every contract must be linked to a file
```

```
context Contract
inv contractandfile:
self.associatedwith->notEmpty()

--Each file has atleast some keywords
context File
inv fileandkeyword:
self.contains->notEmpty()

--The start date of a contract must be lesser than the end date
context Contract
inv Startlesserthanend:
self.Start < self.EndDate

--A file can be associated with only one contract number
context Contract
inv Contracttoonefile:
Contract.allInstances -> forAll (f1,f2 | f1.ContractNumber<>f2.ContractNumber implies
f1.associatedwith<>f2.associatedwith)

--A contract start date and end date must be 8 characters in length
context Contract
inv lengthofdate:
self.Start.size=8

--The ApprovalDept must be one of categories either 'NA','HR','Telecom','Facilities'
context Contract
inv Approvaldept:
Contract.allInstances -> forAll(c1 | c1.ApprovalDepartment='NA' or
c1.ApprovalDepartment='HR' or c1.ApprovalDepartment='Facilities' or
c1.ApprovalDepartment='Telecom')
```

--*The keywords for a file will be from the filecontent*

context File

inv dl:

self.FileContent->includesAll(self.contains.Keywords)

Chapter 4 – Inspection List

1. Purpose

The purpose of this document is to provide a checklist for the technical inspectors of the Purchasing Contracts management system. The goal of the technical inspection process is to aid the developer in checking for correctness and consistency with the architectural design, which ensures the quality of the software design.

2. Items to be Inspected

• Class diagrams

• Sequence diagrams

• Formal Specification

• USE Model

ITEMS TO BE INSPECTED	PASS/FAIL/PARTIAL	COMMENTS
Have the entire requirements been stated clearly in the vision document?		
Do the symbols used in the class diagram conform to UML standards?		
Do the class diagrams have descriptions that are being provide in the architectural design document		

Has the USE model been designed such that it matches with the classes and its respective attributes in the class diagram		
Do the multiplicities in the class diagram match the associations in the USE model		

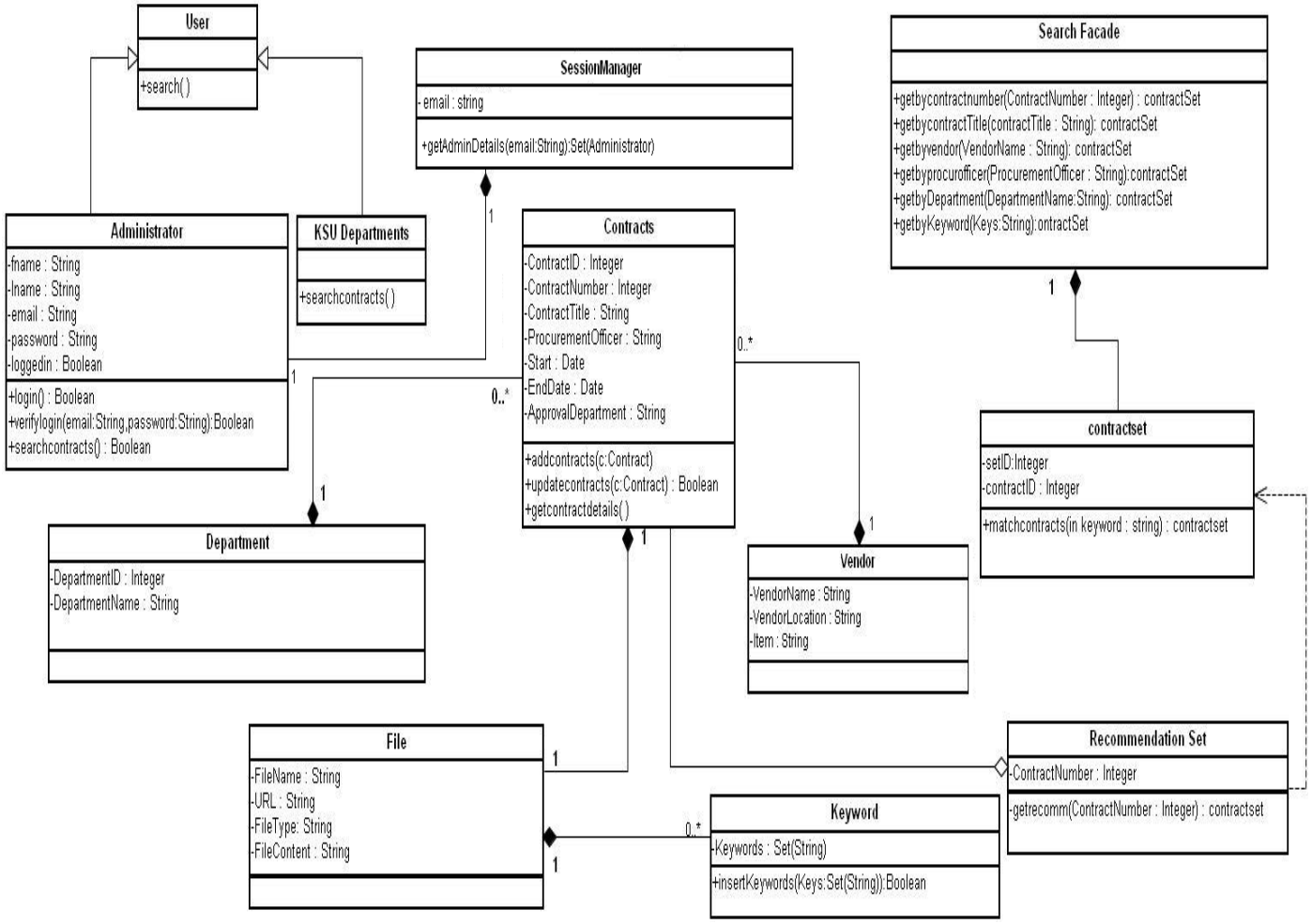
Table 5: Formal Technical Inspection List

Chapter 5 – Component Design

1. Introduction

The purpose of this document is to provide a component design for the Purchasing Contracts Management System. The design will outline the internal design of each component.

2. Class Diagram



2.1. Class Descriptions

2.1.1. Administrator

This class will handle the actions that are performed by the procurement officer. The procurement officer of the purchasing department plays the role of an administrator in our system. It also inherits all of the user class responsibilities and its functions.

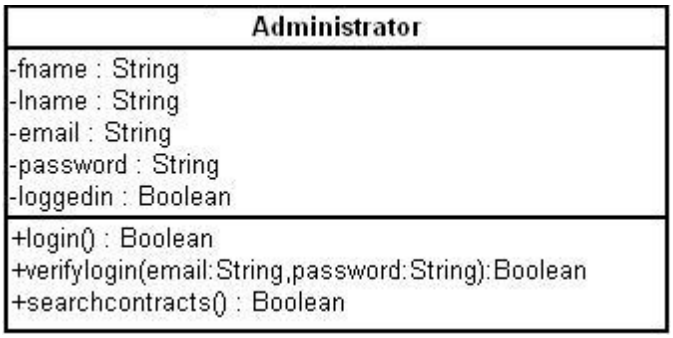


Figure 17 :Administrator class component diagram

Attributes and Methods:

- fname: The administrators first name .
- lname: The administrators last name.
- email: The administrators email address.
- password: The administrators password required for logging into the system.
- loggedin: Responsible for authenticating and authorizing the user to user secure pages of the website.
- login() : Responsible for administrator login to the system.
- verifylogin():Responsible for authenticating and authorizing the administrator to secure pages of the website.
- searchcontracts():Responsible for searching details of a contract.

2.1.2. KSU Departments

Figure 18 : KSU Departments class component diagram

The KSU department's class will handle the actions that are performed by the departments of Kansas State University. It also inherits all of the user class responsibilities and its functions.

Attributes and Methods:

- searchcontracts() : Responsible for searching the contract details based on users input.

2.1.3. Users

Figure 19 : User class component diagram

This class will handle all user actions. The User class is the super class of KSU Departments and Administrator.

Attributes and Methods:

- search() : Searches for contracts in the system.

2.1.4. SessionManager:

Figure 20 : Session Manager class component diagram

Attributes and Methods:

- email : The administrator's email id.
- getAdminDetails() : Responsible for getting administrator's information based on the administrator email address.

2.1.5. Contracts

This class represents the contracts.

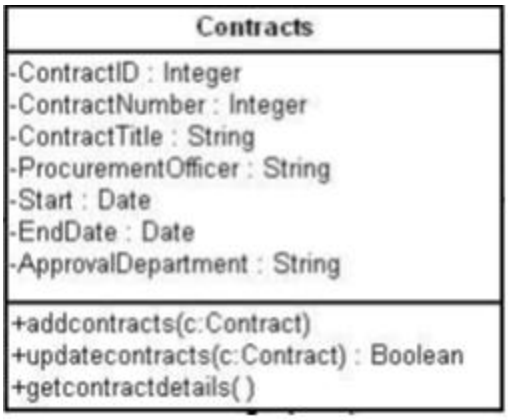


Figure 21 : Contracts class component diagram

Attributes and Methods:

- ContractID : The contracts ID value.
- ContractNumber :The number of the contract.
- ContractTitle : The contracts title.
- ProcurementOfficer : The procurement officer responsible for the contract.
- Start : The starting date of the contract.
- EndDate: The contract expiration date.
- ApprovalDepartment : The department that needs to pre-approve before submitting the order for the item in the contract.
- addcontracts() : Responsible for adding new contract details to the system.
- updatecontracts(): Responsible for updating the details of existing contracts.
- getcontractdetails(): Responsible for retrieving the details of contracts.

2.1.6. Vendor

This class primarily refers to the details of all the contracts.

Figure 22 : Vendor class component diagram

Attributes and Methods:

- VendorName: Refers to the name of the vendor.
- VendorLocation: Refers to the address of the vendor.
- Item: Refers to the item that the vendor is associated with.

2.1.7. SearchFacade

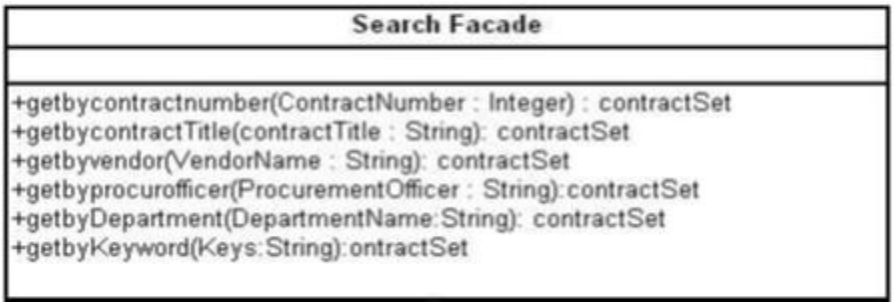


Figure 23 : Search facade class component diagram

This class primarily contains methods that are used to retrieve the search results based on the options chosen by the user.

Attributes and Methods:

- getbycontractnumber() : Responsible for retrieving the details of the contract from the contract number entered by the user.
- getbycontractTitle() : Responsible for retrieving the details of the contract from the contract title entered by the user.
- getbyvendor() : Responsible for retrieving the details of the contract from the vendor name entered by the user.
- getbyprocurofficer() : Responsible for retrieving the details of the contract from the name of the procurement officer entered by the user.
- getbyDepartment() : Responsible for retrieving the details of the contract from the department name the contract belongs to, entered by the user.
- getbyKeyword():Responsible for retrieving the details of the contract from the contract number/title/vendor name, procurement officer/any other keyword related to the contract entered by the user.

2.1.8. Keyword

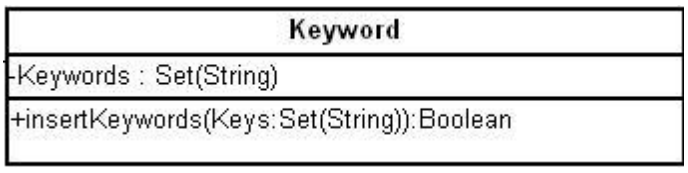


Figure 24 : Keyword class component diagram

This class primarily contains the method that inserts the keywords for the file that is being uploaded.

Attributes and Methods:

- Keywords: The keywords saved in the meta information of the file uploaded.
- insertKeywords(): Responsible for inserting the document properties into the system corresponding to the respective contract number.

Chapter 6 – Software Quality Assurance Plan

1. Purpose

The purpose of this document is to ensure that a high quality software product is being produced. The tools and techniques that are required in order to achieve the above goal are stated in the document and the deliverables at each phase are listed.

2. Reference Documents

- Vision Document
- Project Plan
- IEEE Guide for Software Quality Assurance Planning
- IEEE Standard for Software Quality Assurance Planning

3. Management

3.1 Organization

Supervisory Committee:

- Dr. Daniel Andresen
- Dr. Scott De Loach
- Dr. Mitchell Neilsen

Major Professor:

- Dr. Daniel Andresen

Developer

- Arthi Subramanian

Formal Technical Inspectors

- Srunokshi Neelakantan
- Krishnaveena Ramavat

3.2 Responsibilities

Supervisory Committee

The role of the supervisory committee will be to provide comments and feedback about the progress of the project at the end of each phase. The developer takes the comments from the committee as an input and improves the project features and functionalities.

Major Professor

The major professor will supervise and evaluate the work and progress done by the developer on a weekly basis during the project meetings.

Developer

The developer meets with the major professor on a weekly/bi-weekly basis and discusses the progress of the projects. The major professor guides the developer by discussing the project expectations, goals and possible enhancements to the project. The developer maintains a timelog of project activities he has performed.

Formal Technical Inspectors

The formal technical inspectors are responsible for a formal inspection of the architecture design artifacts and the formal requirements specifications. On completion of the formal technical inspection, the technical inspectors will submit a report on their findings.

3.3 Tasks

All tasks to be performed are documented in the Project Plan. This is reviewed after the first phase to incorporate any changes. A Gantt chart that provides a schedule of each task is also included.

4. Documentation

The documentation consists of a vision document, project plan, software quality assurance plan, architecture design, test plan, formal technical inspection, prototype, user manual, component design, source code, assessment evaluation, project evaluation, references, and formal technical inspection letters. The committee members will review all documentation for final approval.

All documentation is posted on the developer's webpage located at :

http://people.cis.ksu.edu/~arthis/Arthi_MSEProject/Arthi_MSEproject.html

5. Standards, Practices, Conventions and Metrics

5.1. Documentation Standards

IEEE standards will be followed for all applicable documentation throughout the course of the project documentation.

5.2. Coding Standards

The project follows the XHTML standard for web design and development. Each block of statements will be well commented. All the files, modules will contain the authors name, date, last modified on, description of what functionality the block of code achieves.

5.3. Metrics

COCOMO II will be used to estimate the project cost in terms of time and effort.

6. Reviews and Audits

The supervisory committee will evaluate the documentation and the executable product at the end of each phase. The primary purpose of conducting such reviews is to focus on the quality of the product being developed. The two formal inspectors will formally inspect the architecture, design and source code and report their findings.

7. Testing

The test plan will contain a list of all test procedures and their expected results. Further the results of these tests also form a part of the test plan document. Thus a list of test cases are first developed, further executed and documented.

8. Problems Reporting and Corrective Actions

All the problems detected during the development of the system will be recorded in the

Software Problem Report spreadsheet. Each problem detected will be recorded by defining the parameters – problem description, time consumed to fix the bug, the correction actions taken. If

there are any such problems that are not solved they will be brought to the notice of the major professor and discussed.

9. Deliverables

The following set of deliverables will be submitted at the end of each phase:

Phase I

- Vision Document
- Project Plan
- Software Quality Assurance Plan
- Time Log
- Presentation

Phase II

- Action Items – identified during Phase I
- Vision Document
- Project Plan
- Formal Requirement Specification
- Architecture Design
- Test Plan
- Formal Technical Inspection – submitted by two individual MSE students
- Executable Architecture Prototype
- Time Log
- Presentation

Phase III

- Action Items – identified during phase II
- User Manual
- Component Design
- Source Code
- Assessment Evaluation
- Project Evaluation
- Test Results
- References
- Formal Technical Inspection – submitted by 2 MSE students

Presentation

Chapter 7 – Test Plan

1. Introduction:

The purchasing contracts management system is a system designed for the purchasing department in the Division of financial services, Kansas State University. The system is primarily intended to ensure that adding, updating and searching for contract details are made much easier and user interactive than the current system.

Testing of this system is primarily done to order to ensure that the system meets the requirements stated in the Software requirement specification document; in order to do so we create a test plan for the system that follows the standards of IEEE test plan document.

1.1.Objectives:

The test plan must include the entire features that need to be tested, the approach used to test the same, the tools used for testing and environment in which the test needs to be conducted. In addition it also needs to include the pass/fail criteria for each feature and the deliverables of the testing process.

2. Feature to be tested:

The following are the features that will be tested:

Role	Feature Identifier	Description
Administrator	I-01	Application Login
Administrator	I-02	Add a new contract
Administrator	I-03	Update Existing contract
Administrator and user	I-04	Search for contract details

Table 6 : Features to be Tested

3. Test Cases for Administrator

3.1.Application Login:

3.1.1. Test 1:

Purpose:	Test that users can login to the system with the correct username and password.
Actual Input	Incorrect email and/or password entered.
Pass criteria	"Incorrect login credentials" message must be displayed to the user.
Expected Input	Email/password combination that matches with the one in the database.
Pass criteria	User should be able to login on the website and directed to the requested Web page.
Steps	1. Visit Login.aspx Web page 2. enter username and password 3. click login button 4. "Incorrect login credentials" message displayed.

3.1.2 Test 2:

Purpose:	Test that users can login to the system with the correct username and password.
Actual Input	Email and/or password not entered.
Pass criteria	"*" displayed near the corresponding text box. The user is not allowed access to other secure web pages.
Expected Input	Email/password must be entered and the combination should match with the one in the database.
Pass criteria	User should be able to login on the website and directed to the requested Web page.
Steps	1. Visit Login.aspx Web page 2. Blank email and/or password

	3. click login button 4. “*” displayed near the corresponding blank textbox indicating it is a required fields.

3.2 Add a new contract

3.2.1. Test 1:

Purpose:	Test that administrators are able to add new contracts to the system.
Actual Input	Already existing contract number.
Pass criteria	“Contract Number already exists. Click to update the contract” message should be displayed to the user. On clicking the update contract link the update page must be displayed to the user.
Expected Input	Contract number that does not exist in the database is added.
Pass criteria	The contract number along with it respective details must be stored in the database and a “Contract details are saved successfully” message must be displayed to the user.
Steps	1. Visit InsertContract.aspx Web page 2. Enter an already existing contract number and details 3. click Submit button 4. “Contract Number already exists. Click to update the contract” message appears.

3.2.2. Test 2:

Purpose:	Test that administrators are able to add new contracts to the system.
Actual Input	Contract number and/or Contract title and/or Vendor and/or Procurement officer and/or Start date and/or End date and/or Department Name not entered
Pass criteria	“*” displayed near the corresponding text box. The details are not stored in the database.

Expected Input	Contract number, contract title, vendor, procurement officer, comments, departments approval if required, contract start date and end date, department, Contract file to be uploaded/link to the contract file.
Pass criteria	The contract details must be stored in the database and a "Contract details are saved successfully" message must be displayed to the user.
Steps	1. Visit InsertContract.aspx Web page 2. Blank Contract number and/or Contract title and/or Vendor and/or Procurement officer and/or Start date 3. click Submit button 4. "*" displayed next to the blank text box.

3.2.3. Test 3:

Purpose:	Test that administrators are able to add new contracts to the system.
Actual Input	Enter a negative contract number.
Pass criteria	"Please enter a valid contract number" message is displayed next to the contract number text box.
Expected Input	A positive contract number not existing in the database
Pass criteria	The contract details must be stored in the database and a "Contract details are saved successfully" message must be displayed to the user.
Steps	1. Visit InsertContract.aspx Web page 2. Enter a negative contract number. 3. "Please enter a valid contract number" message is displayed.

3.2.4. Test 4:

Purpose:	Test that administrators are able to add new contracts to the system.

Actual Input	The URL containing the master contract is not entered/no master file is uploaded.
Pass criteria	"*" message is displayed next to the "Link to master contract" textbox.
Expected Input	Either the master file is uploaded or a link to the URL containing the master contract file is mentioned.
Pass criteria	The contract details along with the link to the master contract file must be stored in the database and a "Contract details are saved successfully" message must be displayed to the user.
Steps	1. Visit InsertContract.aspx Web page 2. Blank URL or no contract file is uploaded. 3. Click Submit 4. "*" displayed next to the blank text box.

3.3. Update existing contracts

3.3.1. Test 1:

Purpose:	Test that administrators are able to update details of an already existing contract.
Actual Input	Edit the end date to be lesser than the start date.
Pass criteria	"End date cannot be lesser than start date" message is displayed.
Expected Input	End date greater than start date
Pass criteria	The contract details must be updated in the database and a "Contract details updated successfully" message must be displayed to the user.
Steps	1. Visit UpdateContract.aspx Web page 2. Enter an end date lesser than the start date 3. "End date cannot be lesser than start date" message is displayed.

3.4. Search for existing contracts

3.4.1. Test 1:

Purpose:	Test that administrators are able to search details of an already existing contract.
Actual Input	Enter a contract number not existing in the database and click the search button.
Pass criteria	"No records found" message is displayed.
Expected Input	Enter a contract number existing in the database, set the search filter to 'Contract Number' and click the Search button.
Pass criteria	The contract details are retrieved from the database and populated in the grid.
Steps	1. Visit Contracts.aspx Web page 2. Enter a contract number in the search textbox and set the search by filter to 'contract number'. 3. "No records found" message is displayed since the contract number does not exist in the contracts database.

3.4.2. Test 2:

Purpose:	Test that administrators are able to search details of an already existing contract.
Actual Input	Enter a search text, set the search filter to keywords and click on search
Pass criteria	The text must be searched across the contract number, contract title, vendor name, procurement officer name, comments and the keywords of the uploaded file. The contract details corresponding to a successful match must be retrieved with a link to the master contract file.
Expected Input	Enter a search text, set the search filter with respect to the type to search to be performed.

Pass criteria	The contract details are retrieved from the database and populated in the grid.
Steps	1. Visit Contracts.aspx Web page 2. Enter a contract number in the search textbox and set the search by filter to 'Keywords'. 3. Contracts that match the search criteria must be populated in the grid.

3.4.3. Test 3:

Purpose:	Test that administrators are able to search details of an already existing contract.
Actual Input	Click on the "Display All" button and further set the "filter by" field to a department name.
Pass criteria	All the contracts are displayed initially and once the "filter by" field is set o department name, only those contracts that are associated with that particular department are retrieved.
Expected Input	Click the "Display all" button
Pass criteria	All contracts are retrieved from the database and populated in the grid.
Steps	1. Visit Contracts.aspx Web page 2. Click the "Display All" button 3. All the contracts and their respective details are populated in the grid. 4. Under filter by on the right side of the page, set the Departments to "KSU". 5. Contracts that are associated with KSU are displayed on the grid.

4. Approach:

The features above mentioned describe the steps the user takes to interact with the system and hence it is important to do some manual testing in order to ensure that the navigation is functioning as expected. These interactions with the system will be simulated through a series of test scenarios. The following are the various approaches that will used in order to test the purchasing contracts management system.

4.1. Unit Testing:

Each and every module will be tested separately to determine any errors that might exist in the code. This approach is followed so as to ensure that errors are easily identified and fixed. Since unit testing focuses on small portions of the functionality, for the application under consideration, unit tests verifying that correct data is saved to the database, the contract details pertaining to a given contract number are retrieved, contract details of a contract number are updated are verified. The primary focus of unit testing is to ensure that obvious errors are eliminated.

4.2. Performance Testing:

Performance testing is used to determine the speed/effectiveness of the system under consideration. JMeter is used to perform load testing and check for performance of the system. The search for contracts page will be primarily subjected to this kind of testing. The following components are analyzed for performance.

1. Searching for contracts
2. Updating: Searching for contracts, selecting a contract and further updating it.

It is important to define a clear set of expectations in order to conduct a meaningful performance testing. Some of the inputs for performance testing a web application are to define the performance acceptance criteria such as the response time, resource utilization, throughput etc. Once these parameters are clearly defined and we know where the value range must exist, we can slowly increase the load of the system and look for bottlenecks. The throughput refers to the number of transactions

per second an application can handle. Thus the main outcomes that performance testing helps us achieve are- potential bottlenecks might exist due to inefficiencies in code; inefficient or high load SQL statements etc, various performance measures such as throughput, resource utilization, and response time and the behavior of the application at different load levels.

- **Manual Testing:**

  Manual testing is done to ensure the correctness of code.

5. Item Pass/Fail Criteria:

Test cases executed on the purchasing contracts management system will pass if the pre and post conditions produce expected results. If these conditions are not met then they the test case fails.

6. Suspension Criteria and Resumption Requirements

6.1 Suspension Criteria

In case a failure occurs when performing testing the testing will be suspended for all the dependent features. It is important to log the test along with a description of the reason behind the failure.

6.2 Resumption Requirement

There might be a number of test cases that are not dependent on each other and such test cases can be executed under any circumstance. However a number of test cases exist that depend on other test cases. For such test cases, if there is a bug in the primary test case, it first needs to be resolved before proceeding to execute the dependent test case.

7. Test Deliverables

The following documents are delivered after the testing is performed on purchasing contracts management system. They are as follows:

The test plan, test cases and the test log.

8. Environmental Needs

8.1 Software

Microsoft Visual Studio .NET 2005, and NUnit will be used for developing and testing respectively.

8.2 Operating System

Testing and developing is performed in Windows Vista

Chapter 8 – Assessment Evaluation

1. Introduction

This document presents the results of the functional testing performed on Purchasing Contracts Management System. The test cases are in reference to the test cases defined in the Test Plan 1.0 from Phase II.

2. Testing Results Summary

The following are the features that will be tested:

	Test Case	**Description**	**Results/Comments**
Administrator	I-01	Application Login	Passed
	I-02	Add a new contract	Passed
	I-03	Update Existing contract	Passed
Administrator and User	I-04	Search for contract details	Passed

3. Detailed Test Results

3.1. Manual Testing

Manual Testing of the system was done to ensure the correctness of various parts of the code.

3.1.1. Test Case 01 – Application Login

Test Unit	**Test Case**	**Result**
btnlogin	An empty Email and/or password field.	"*" displayed near the corresponding text box. The user is not allowed access to other secure web pages.
	An invalid Email and/or	System prompts user to enter

	password entered	the email and password with a message “Incorrect login credentials”

3.1.2. Test Case 02 - Add a new contract

Test Unit	Test Case	Result
btnAddcontract	An already existing contract number is added to the system	“Contract Number already exists. Click to update the contract” message is displayed to the user.
	Contract number and/or Contract title and/or Vendor and/or Procurement officer and/or Expiration date and/or Department Name is not entered	“*” displayed near the corresponding text box. Only on addition of the required fields is the contract inserted into the system.
	A negative contract number is entered in the contract number field.	“Please enter a valid contract number” message is displayed next to the contract number text box.
	A value of expiration date lesser than the start date is entered.	“End date cannot be lesser than start date” message is displayed to the user.

3.1.3. Test Case 03 - Update an existing contract

Test Unit	Test Case	Result

btnUpdatecontract	The expiration date field is updated such that the value in the field is lesser than the start date value.	"End date cannot be lesser than start date" message is displayed to the user
	The approval required field is changed from 'NA' to 'HR'.	On click of update the values are updated for the corresponding contract number and the updated details are displayed in the grid.
	Click on the "click to add new contract" link.	A new window with fields to upload new contract files or specify a new URL pops up.
	Search for a contract number that does not exist in the system.	"The contract number does not exist" message is displayed to the user.

3.1.4. Search for existing contracts

Test Unit	Test Case	Result
btnSearchcontract	Enter a contract number not existing in the system, set the dropdown to Contract Number and click Search.	"No records found" message is displayed.
	Enter a vendor name existing in the system, set the dropdown to Vendor and click Search.	All the contracts for the particular vendor are retrieved.

	Click on the “Display All” button and further set the “filter by” field to a department name.	All the contracts are displayed initially and once the “filter by” field is set to department name, only those contracts that are associated with that particular department are retrieved.
	Click on the “Display All” button and further set the “filter by” field to one of the “Approval Required from” value field.	All the contracts are displayed initially and once the “filter by” field is set to value in “Approval Required from” field, only those contracts that require the particular departments approval are retrieved.

3.2 Unit Testing:

To perform unit testing for the purchasing contracts management system, NUnitAsp is a tool for automatically testing ASP.NET web pages was used. It's an extension to NUnit, a tool for test-driven development in .NET.

NUnitAsp is based on the principle that testing web pages should use the same concepts as creating them. When using NUnitAsp, we have used classes and IDs similar to those used when creating the web page you are testing.

Unit testing has been performed for the following pages in the purchasing contracts management system website:

- Contracts page
- Add contracts
- Update contracts

3.2.1. Contracts Page (Class: TestContract.cs)

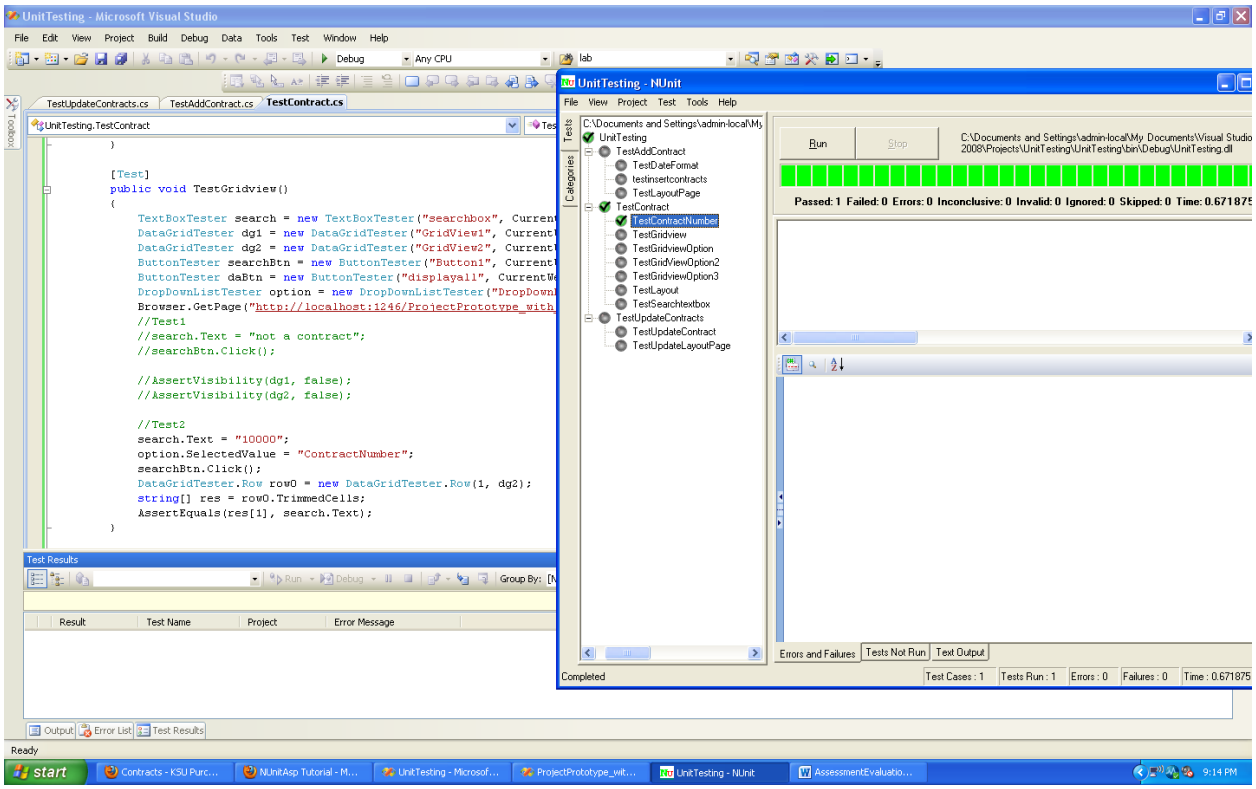
3.2.1.1. Method Name - TestLayout

The first test for the contracts page is to test the layout of the page. We don't test the look of our web page, but we do test the functionality. The first step towards doing this is just making sure the right components are on the page.

In order to test these components, we have to create NUnitAsp "tester" objects. A tester is an object that corresponds to an ASP.NET control that we want to test. The tester can be instantiated at any time—even before the page is loaded. When we instantiate it, we tell the tester the name of the ASP.NET control it's supposed to test and which control it's located on. Hence the first test for the contracts page is to ensure all the controls on the page such as the search text box, search button, display all button, the options drop down are all visible on the page.

3.2.1.2. Method Name - TestGridview

The second test for the contracts page involves entering a value for the contract number, setting the search by filter to Contract Number and clicking on the search button. For the contract number that is entered in the search text box, we ensure that the appropriate row where the second column (contract number) is the same as the search text value is retrieved.

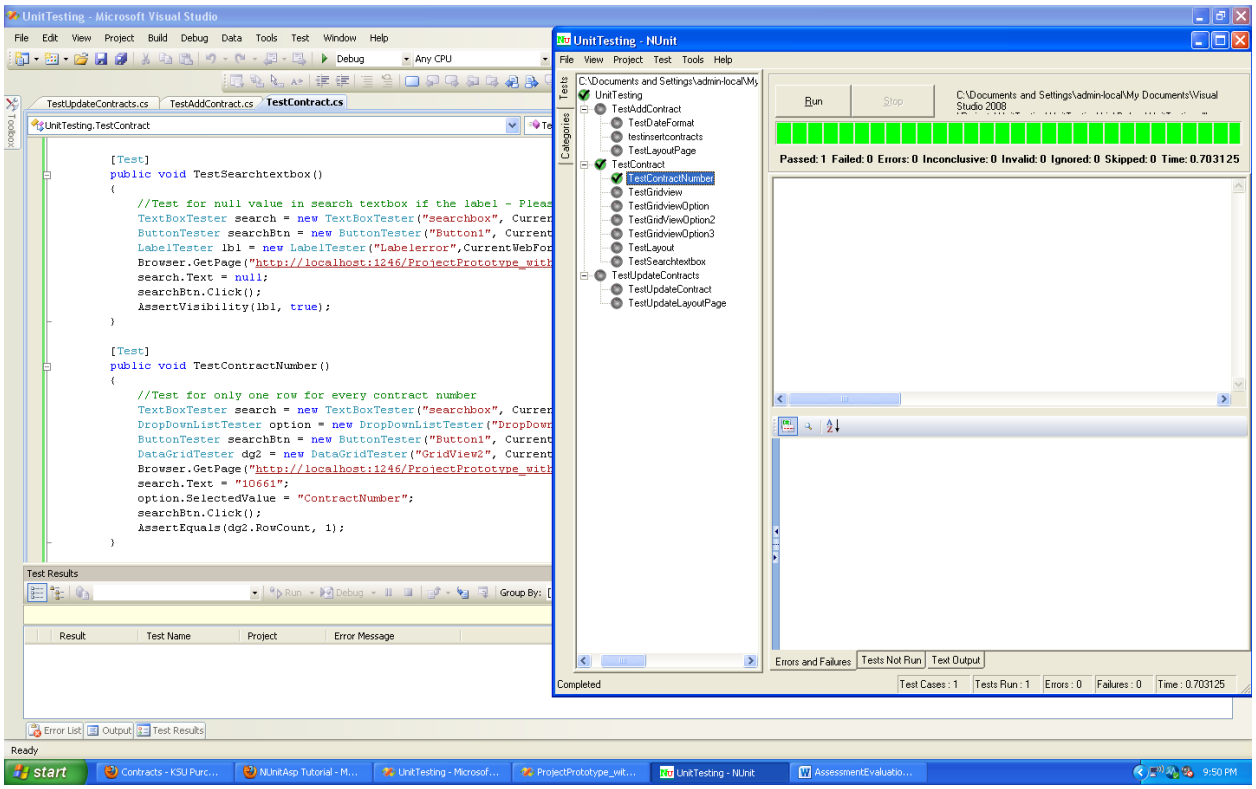

UnitTesting - Microsoft Visual Studio
UnitTesting - NUnit
Passed: 1 Failed: 0 Errors: 0 Inconclusive: 0 Invalid: 0 Ignored: 0 Skipped: 0 Time: 0.671875
Completed

3.2.1.3. Method Name – TestSearchtextbox

The third test for the contracts page involves a null value for the search text box. On click of the search button, we test to ensure if the message – "Please enter a search text" appears.

3.2.1.4. Method Name – TestContractNumber

The fourth test for the contracts page involves entering an existing value of contract number in the search text box. On click of the search button, we test to ensure if exactly one row of contract number value is retrieved to the user.


UnitTesting - Microsoft Visual Studio
UnitTesting - NUnit
Passed: 1 Failed: 0 Errors: 0 Inconclusive: 0 Invalid: 0 Ignored: 0 Skipped: 0 Time: 0.703125
Completed

3.2.1.5. Method Name - TestGridviewOption

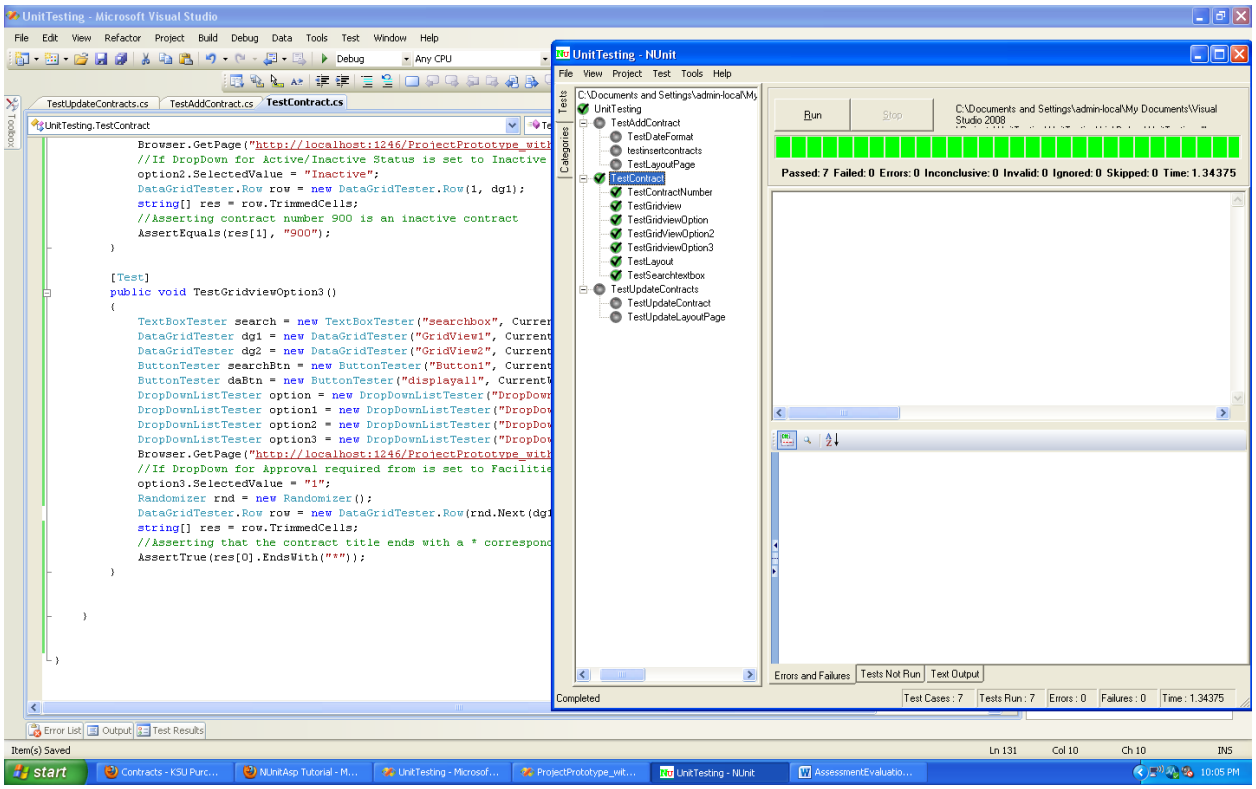
This test for contracts page involves setting the Department drop down to “KSU”, choosing a random value from the data grid that is populated with contracts and further testing that any randomly chosen row from the data grid has the value “KSU” in the sixth column (Department) of the data grid.

3.2.1.6. Method Name - TestGridViewOption2

This test for contracts page involves setting the Status drop down to “Inactive” and further testing that the contract number 900 that is currently set to inactive status exists in the datagrid.

3.2.1.7. Method Name – TestGridViewOption3

This test for contracts page involves setting the Approval Required from drop down to “Facilities”, choosing a random value from the data grid that is populated with contracts and further testing that any randomly chosen row from the data grid has the contract title value ending with a ‘*’.



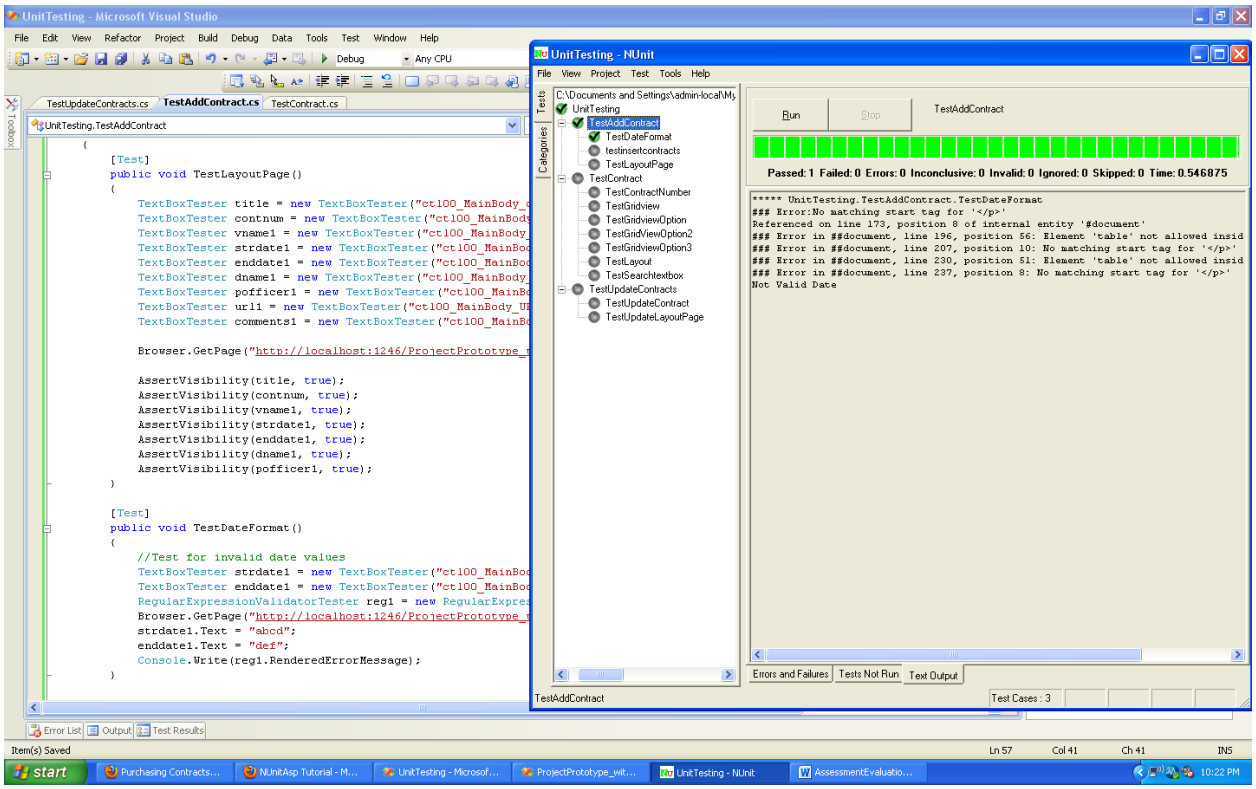
3.2.2. Add contract page

3.2.2.1 Method Name – TestLayoutPage

The TestLayoutPage tests the layout in the add contracts page. It ensure all the controls on the page such as the Contract Title, Contract Number, Vendor Name, Start Date, Expiration Date, Department Name, Procurement Officer name, URL, comments and the Insert button are all visible to the user of the system.

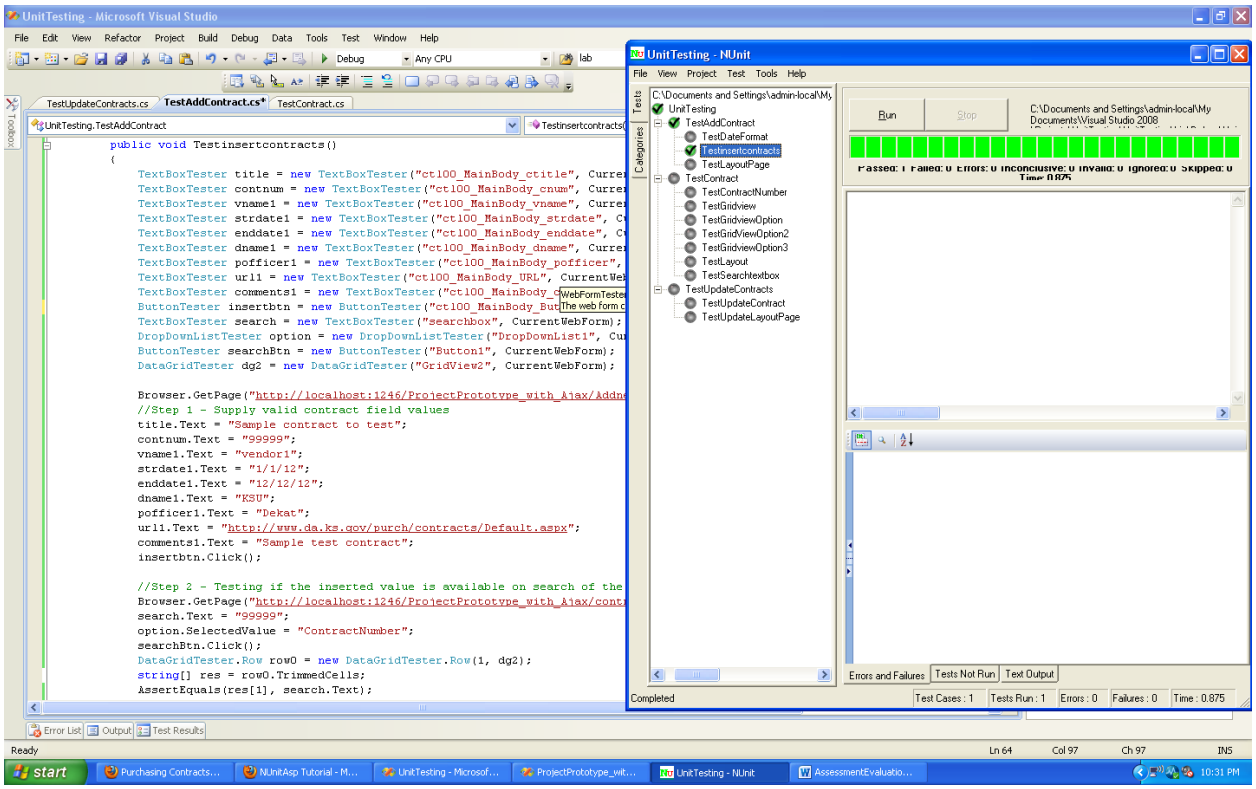
3.2.2.2 Method Name – TestDateFormat

The TestDateFormat tests the start date field by entering a string of alphanumeric characters as its input. The console is checked to test the error message rendered. A “Not Valid Date” message was rendered in the console.


UnitTesting - Microsoft Visual Studio
UnitTesting - NUnit
Passed: 1 Failed: 0 Errors: 0 Inconclusive: 0 Invalid: 0 Ignored: 0 Skipped: 0 Time: 0.546875
Not Valid Date

3.2.2.3 Method Name – Testinsertcontracts

The Testinsertcontracts performs a test on the actual functionality of the Add contracts page. In the first step the add contracts page is retrieved. To this page the contract details such as the Contract Title, Contract Number, Vendor Name, Start Date, Expiration Date, Department Name, Procurement Officer name, URL, comments are all entered and the insert button is clicked. In the second step, the contracts page is retrieved, and in the search for text box the value of the contract number that was just inserted is entered, the drop down is set to contract number and the search button is clicked. The test ensures that the contract entered through the add contracts page is now available to the user through the contracts page.



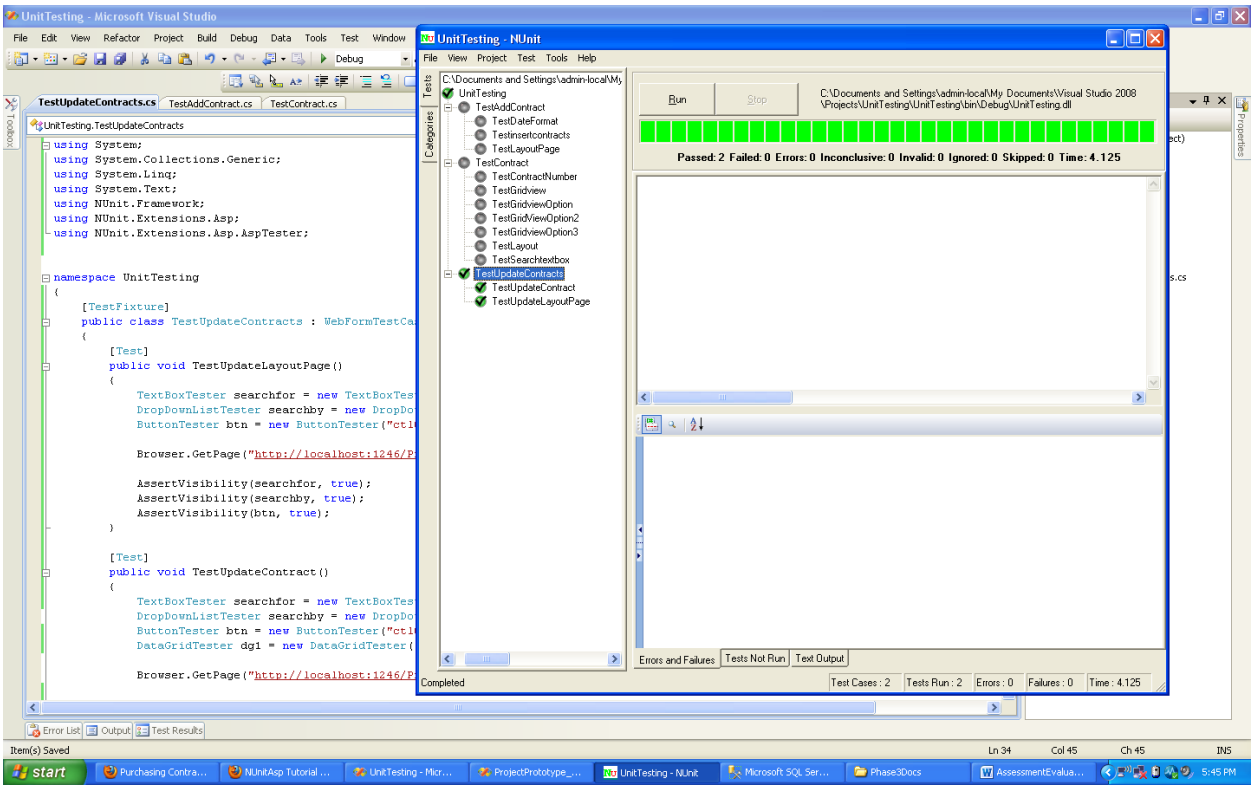
3.2.3. Update contract page

3.2.3.1. Method Name – TestUpdateLayoutPage

The TestUpdateLayoutPage tests the layout in the update contracts page. It ensure all the controls on the page such as the search for text box, the search by dropdown and the search button are all visible to the user of the system.

3.2.3.2. Method Name – TestUpdateContract

The TestUpdateContract tests if the values of the contract title, vendor name, procurement officer name, start date, expiration date, department name, URL can be updated on the page. The test first performs the update and further ensures that the updated values exist in the system.



3.3 Performance Testing:

To test the performance of the system the tool, Jakarta JMeter, was used to simulate the virtual users (clients). Apache JMeter is a 100% pure Java desktop application designed to load test client/server software (such as a web application). It may be used to test performance both on static and dynamic resources such as static files, Java Servlets, CGI scripts, Java objects, databases, FTP servers, and more. JMeter can be used to simulate a heavy load on a server, network or object to test its strength or to analyze overall performance under different load types. Performance testing is primarily used to to achieve an estimate of the peak and sustained load the application can handle for Wireless connection. A webpage from each of the following category is selected and tested for wireless connection:

A database intensive page – **contracts.aspx**

Since the Addcontracts.aspx and the updatecontracts.aspx page will be used by only the procurement officer, load testing need not be performed for the same.

3.3.1 Wireless Connection at 36.0 Mbps for Peak Load

The response time for different combinations of users and requests is noted.

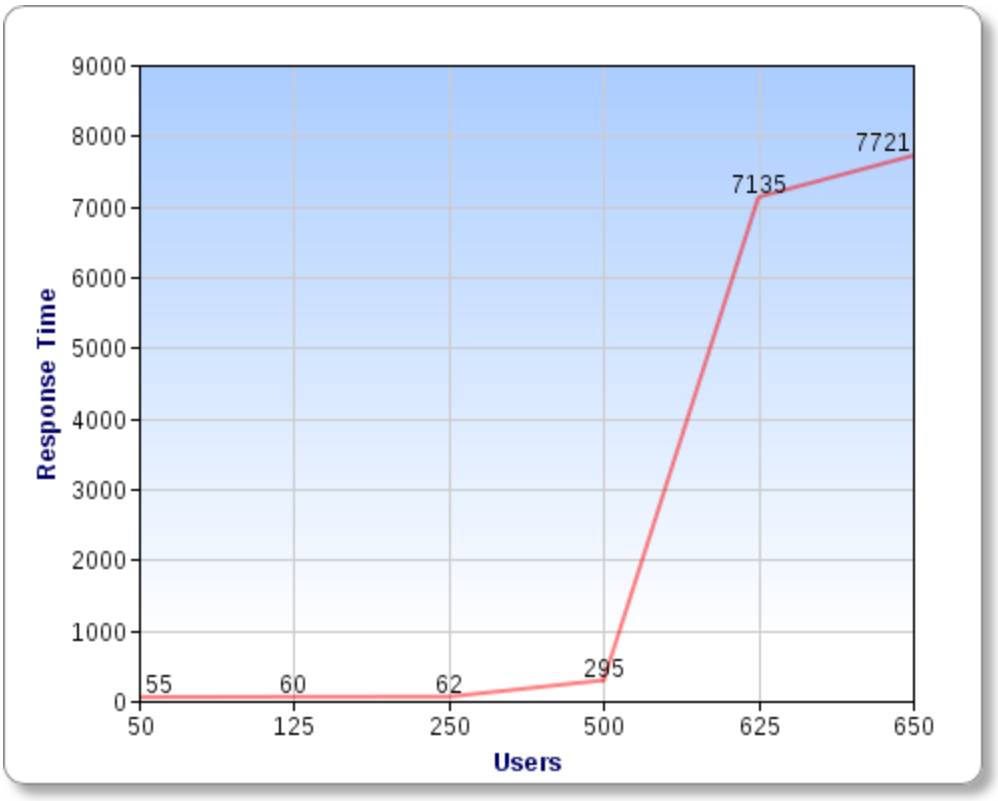
Test 1:

In the first test, the loop count is kept constant at 2000 and the number of users are increased. The results are noted for 50, 125, 250, 500, 625 and 650 users.

Users	Loop Count	Total Number of requests	Ramp up period(in seconds)	Average Response Time (in ms)	Throughput
50	2000	100,000	5	55	981
125	2000	250,000	5	60	2449.78
250	2000	500,000	5	62	4887.9
500	2000	1,000,000	5	295	9004.18
550	2000	1,100,000	5	197	10,250
625	2000	1,250,000	5	7135	6410.4
650	2000	1,300,000	5	7721	5648

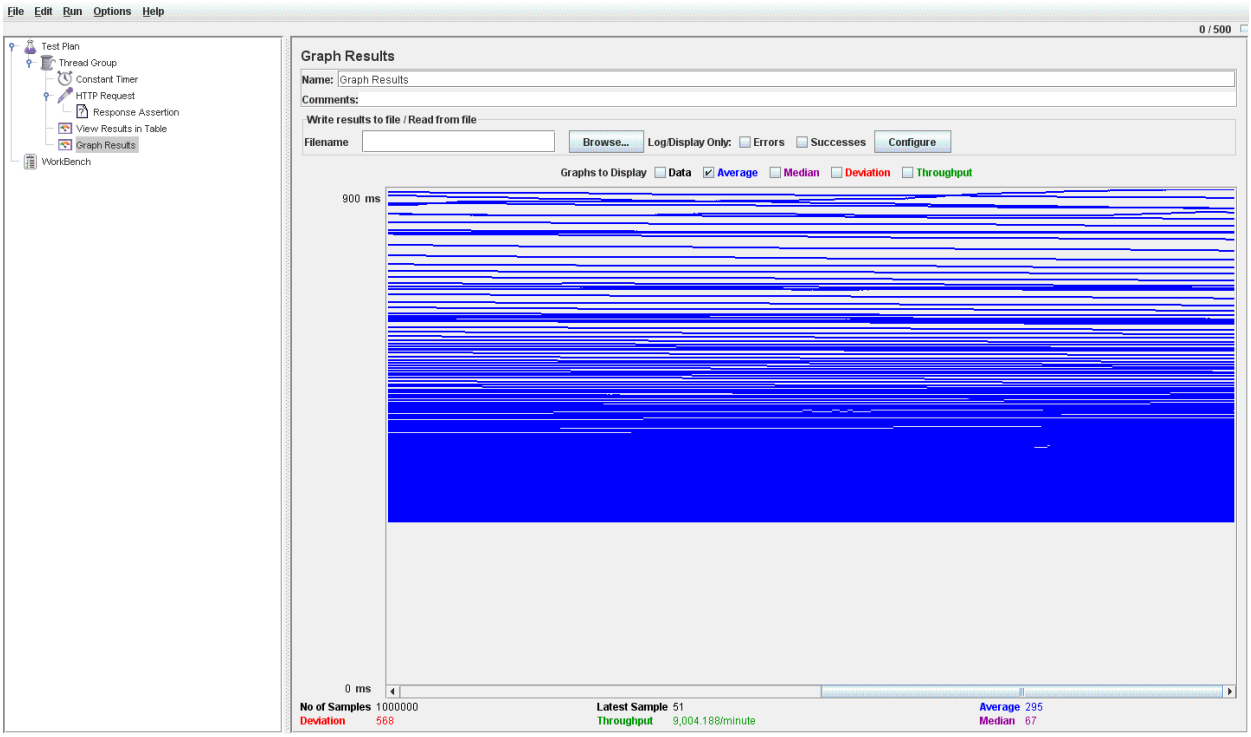
Table 7 : Test Case Result Summary

The following is a graph plotted for the number of users against the response time. We may notice from the chart that when the number of users increases from 250 to 500 we notice a major increase in the average response time. There is a even higher increase in response time when the number of users are increased from 500 to 625. Thus it may be concluded from our test that for the contracts.aspx page as the number of users increase the average response time also increases.

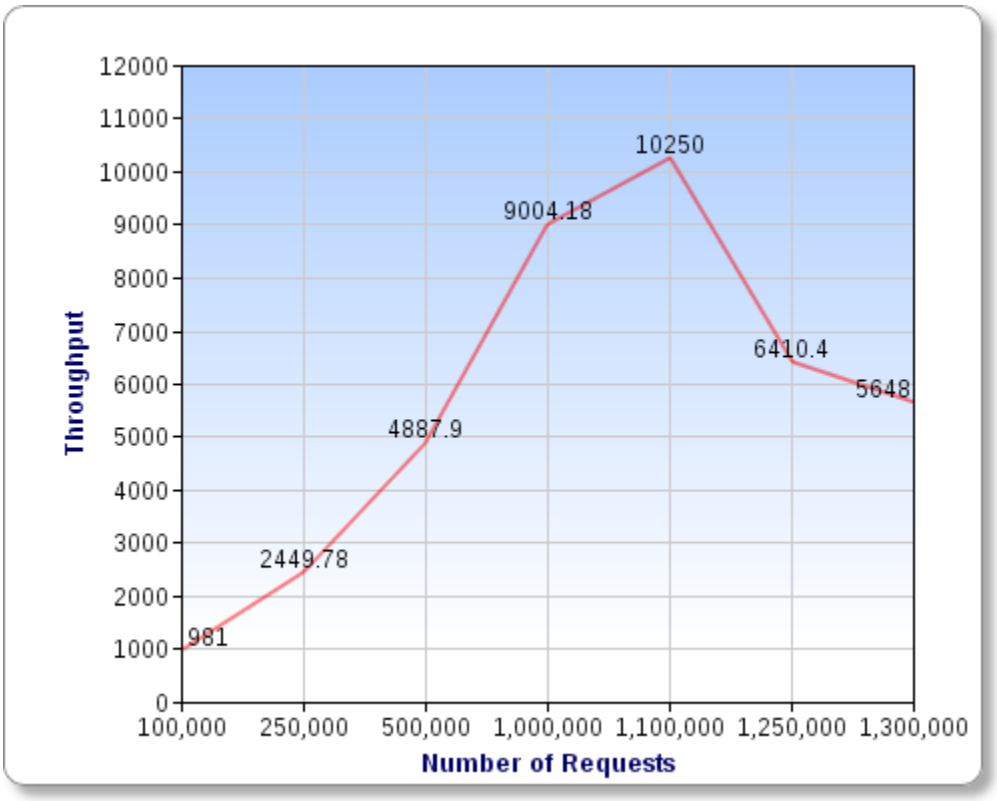


The following is a Jmeter graph plotted for 1,000,000 samples.

Users	Loop Count	Total Number of requests	Ramp up period(in seconds)	Average Response Time (in ms)	Throughput
500	2000	1,000,000	5	295	9004.18



The following is a graph that plots the number of requests(X-axis) against the throughput(Y-axis). From the graph we observe that with increase in the total number of requests the throughput also increases.

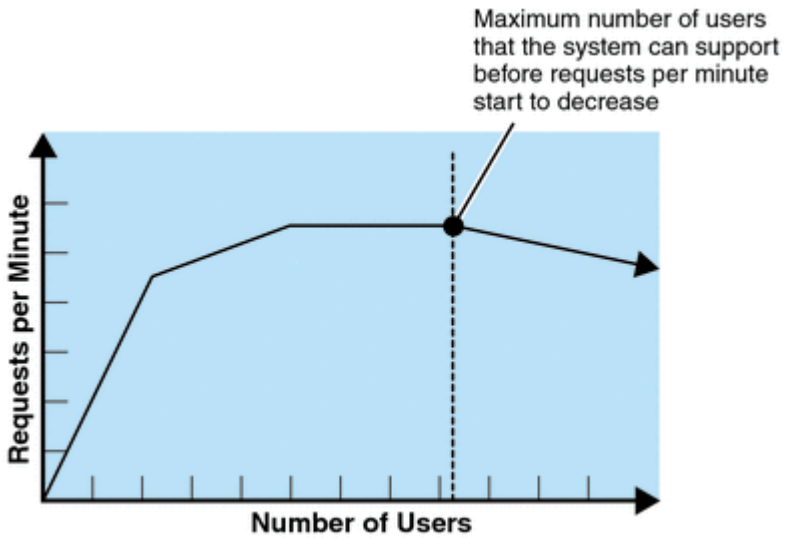


Observation:

From the above graph we notice that the throughput (i.e requests processed per minute) is increasing with the number of requests upto 1.1 million requests. Initially, as the number of users increases, throughput increases correspondingly. However, as the number of concurrent requests increases, server performance begins to saturate, and throughput begins to decline.

Hence at 1.1 million requests, adding concurrent users reduces the number of requests that can be processed per minute. This point indicates when optimal performance is reached and beyond which throughput start to degrade.

For example,


Maximum number of users that the system can support before requests per minute start to decrease
Requests per Minute
Number of Users

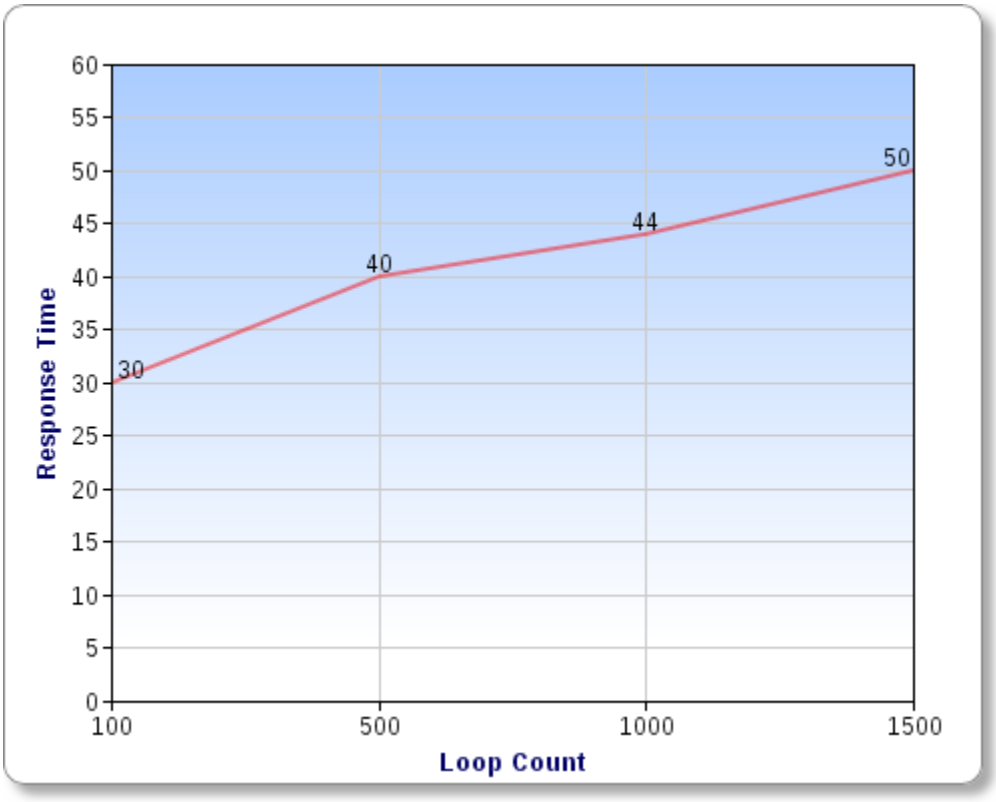
Test 2:

In the second test, we maintain a constant number of users and increase the loop count values. The average response time is noted for the same.

Users	Loop Count	Total Number of requests	Ramp up period (in seconds)	Average Response Time (in ms)
100	100	10,000	5	30 ms
100	500	50,000	5	40 ms
100	1000	100,000	5	44 ms
100	1500	150,000	5	50 ms

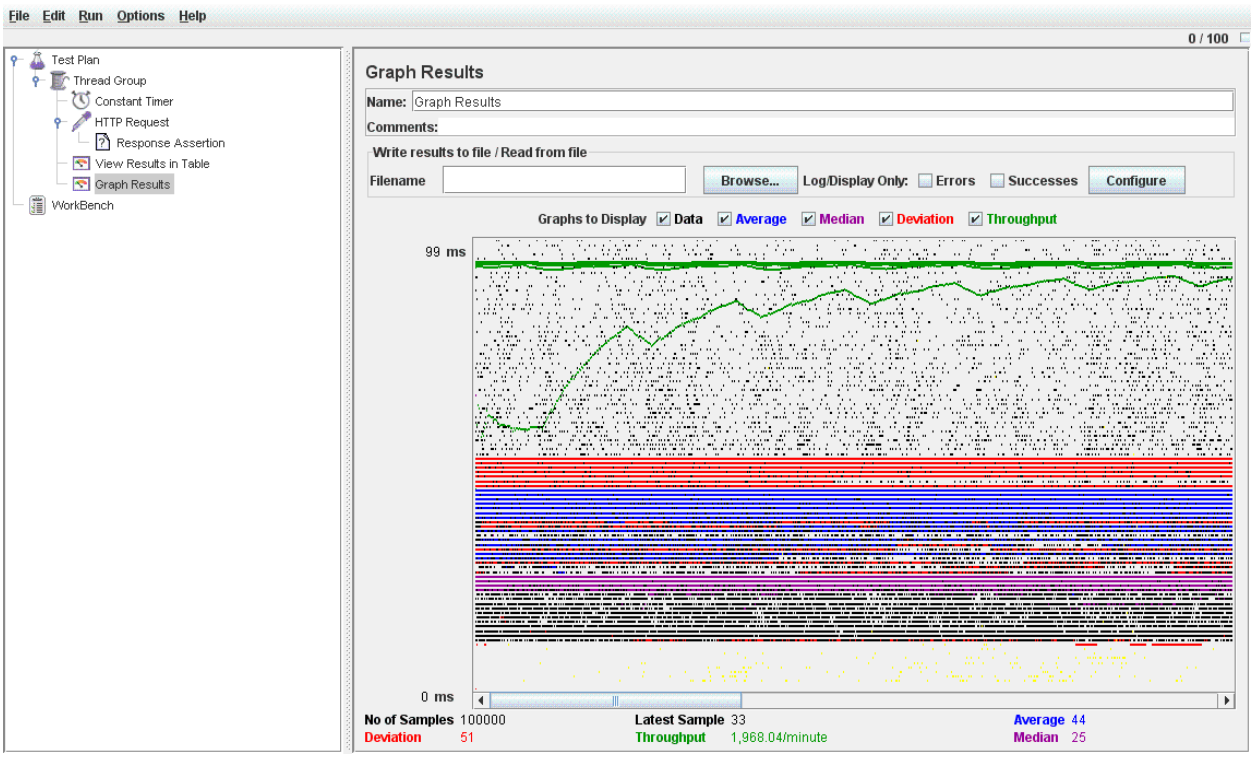
Table 8 : Test2 Result Summary

The following graph is used to plot the loop-count(X-axis) against the average response time(Y-axis). We notice an increase in response time with increase in loop count value. The test was performed for a constant number of users (100 users) and an increase in loop count value from 100,500,1000 and 1500.



The following JMeter graph has been plotted for 100 users and loop count of 1000.

Users	**Loop Count**	**Total Number of requests**	**Ramp up period(in seconds)**	**Average Response Time (in ms)**	**Throughput**
100	1000	100,000	5	44 ms	1968/min



4. Scalability

The Purchasing Contracts Management System is running on a personal version of IIS. A better scalability can be achieved by upgrading a personal version of IIS to a server version of IIS.

The system database server and the IIS server are running on the same machine. An increased performance and scalability can be achieved by using a dedicated database and a web server.

Chapter 9 – User Manual

1. Introduction:

This user manual explains the setup and the use of the Purchasing Contracts Management System.

2. Installation and Set-up

2.1. Required Hardware

- A Microsoft SQL Database Server
  - Servers should be equipped with a processor clock speed over 1.5GHz and a memory over 512mb.
- IIS Web Server
  - Servers should be equipped with a processor clock speed over 1.5GHz and a memory over 512mb.

2.2. Required Software

- Microsoft Windows 2000 Professional or Windows XP Professional
- Internet Information Server(IIS). The IIS Web server is included on Windows 2000 Professional and Windows XP Professional installation CD. (It is not automatically installed so it needs to be installed.)
- .NET Framework 2.0 SDK which may be downloaded from this site: http://www.microsoft.com/downloads/details.aspx?familyid=fe6f2099-b7b4-4f47-a244-c96d69c35dec&displaylang=en
- Microsoft Internet Explorer 6.0.2 (or higher) or Mozilla Firefox for clients
- Microsoft SQL Server 2005 which is installed with Microsoft visual studio 2005.
- SQL Server 2005 Express Manager which can be downloaded from this site: http://msdn2.microsoft.com/en-us/express/aa718378.aspx
- Microsoft Visual Studio 2005 for configuring connection string for the database.

- ASP.NET Ajax 1.0 can be downloaded from this site: http://www.microsoft.com/downloads/en/details.aspx?FamilyID=ca9d90fa-e8c9-42e3-aa19-08e2c027f5d6&displaylang=en

2.3. Required Network Configuration

- A broadband, having a 10Mbp and above, connection is needed to provide fast linkage to the server, thus granting quality service to the user.

2.4. Software Set-up

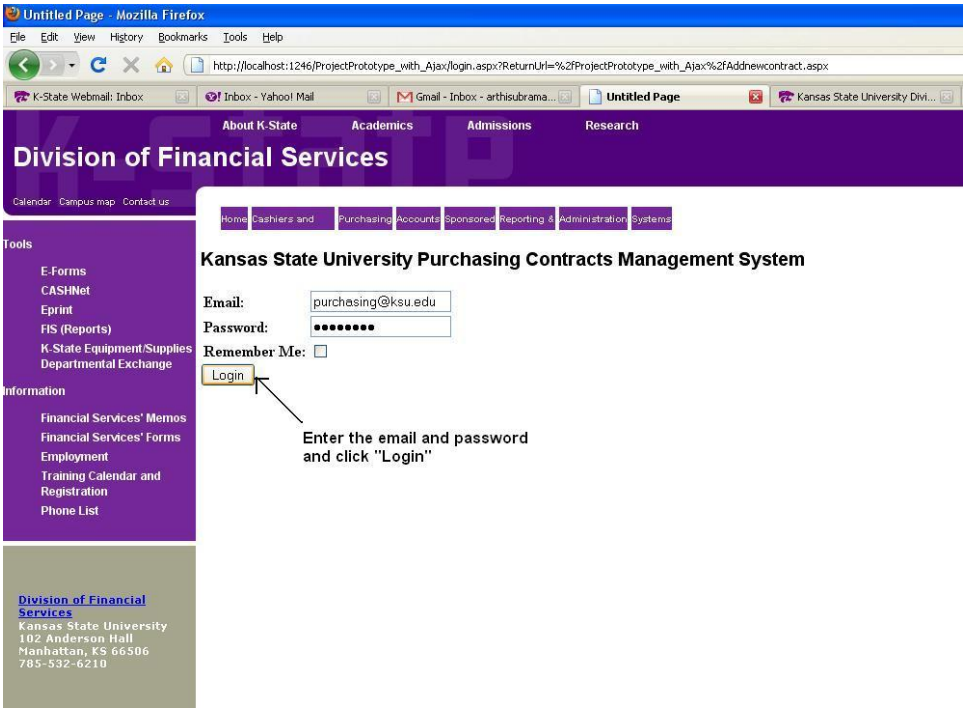
- Unpack the software to the World Wide Web root of the IIS server. (It is usually the "C:\Inetpub\wwwroot" directory.)
- Open the "Web.config" file and change the values of the <add name> property according to your connection configurations
- Open the SQL-Server Manager Studio Express
- Create a database and label it as "foo"
- Click on the query analyzer
- Run the queries mentioned in the 'readme.txt'
- Now all the required tables are created and the stored procedures for the same are also executed.
- Open the Internet Information Services.
- Go to Start -> Control Panel -> Administrative Tools
- Choose the option "Web Sites"
- Right click on "Default Web Site"
- Click on New -> Virtual Directory
- Enter the Alias Name as "PCMS" then click on the "Next" button
- Browse the directory and select the folder where you have unpacked the software, then click on the "Next" button
- Click on the "Next" button
- Finally, click on the "Finish" button

3. Purchasing Contracts Management System Usage

3.1. Administrator:

3.1.1. Administrator Login:

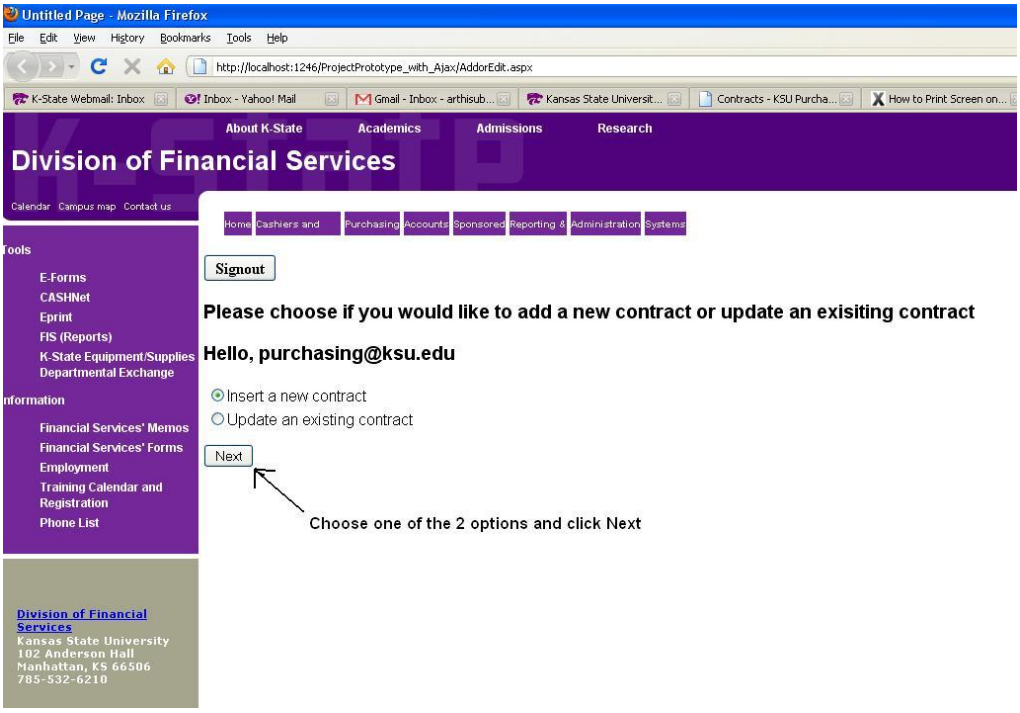
The purpose of this part of the application is to provide user authentication. The user enters the email and password. The system checks for this email and password combination to ensure they are valid. If the email or password is not valid, the appropriate error message will be displayed and the administrator needs to re-enter the email and password. If the inputs are valid, the administrator will be directed to the requested secure web page where he makes a choice to add new contract details or update an existing contract details.



If the user is already logged in, a “Signout” button will be displayed on the top left corner of the screen. The administrator may logout at any time by clicking on this button.

3.1.2. Choice to add or update contracts:

Once the administrator logs in to the system, he makes a choice to add a new contract or update an existing contract. If the administrator wishes to add a new contract to the system, he clicks on the ‘Insert a new contract’ radio button and clicks on ‘Next’. Else if he chooses to update an existing contract he clicks on the “Update an existing contract” radio button and clicks on ‘Next’.



3.1.3. Add new Contracts:

The administrator is now navigated to the ‘Add a new contract’ page. If he wishes to update a contract and mistakenly chose to add contract, a click on the 'Update an existing contract' link below the “Signout” button in the add contracts page helps to navigate to the update contract page.

To create new contract details, the administrator enters the details of the contract in the form presented in the Add new contracts page. The following are the various form fields entered by the administrator.

Contract Title: The contract title refers to the title of the contract. eg: *Advertising, Job Posting*

Contract Number: Refers to the contract number. This is a combination of only numbers or may contain alpha-numeric characters eg: *10000, 12E345*

Vendor Name: Refers to the name of the vendor Eg : *Career Builders*

Start Date : The starting date of the contract. The date must be in the format MM/DD/YY(Month/Date/Year) Eg: *04/19/07*. The date can be entered in the textbox or if the date is in the current year, it can be chosen from the calendar. Ensure extra spaces are not entered before or after the date.

Expiration Date: Refers to the expiration date of the contract. Can be entered in the text-box or chosen from the calendar. Must be in MM/DD/YY format.The system checks to ensure that the end date is always greater than the start date. If otherwise, a message - 'End date must be greater than start date' is displayed. Ensure extra spaces are not entered before or after the date.

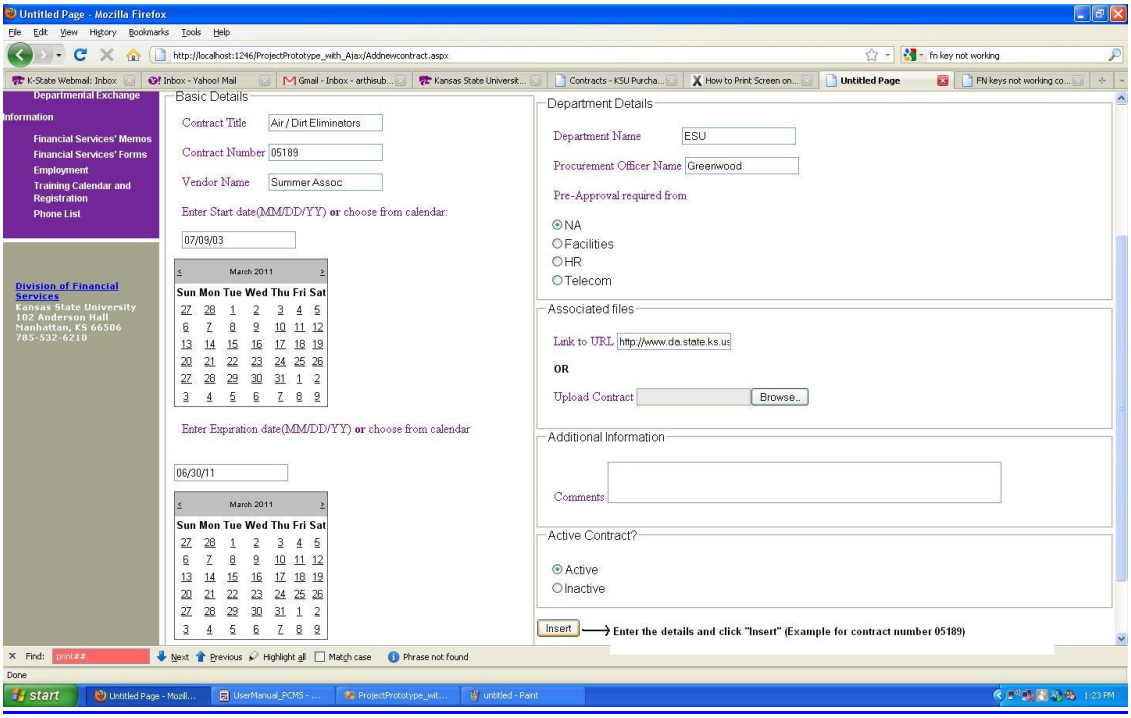
Department Name: The department name is entered here - Eg: *KSU*

Procurement Officer Name: Name of the Procurement officer

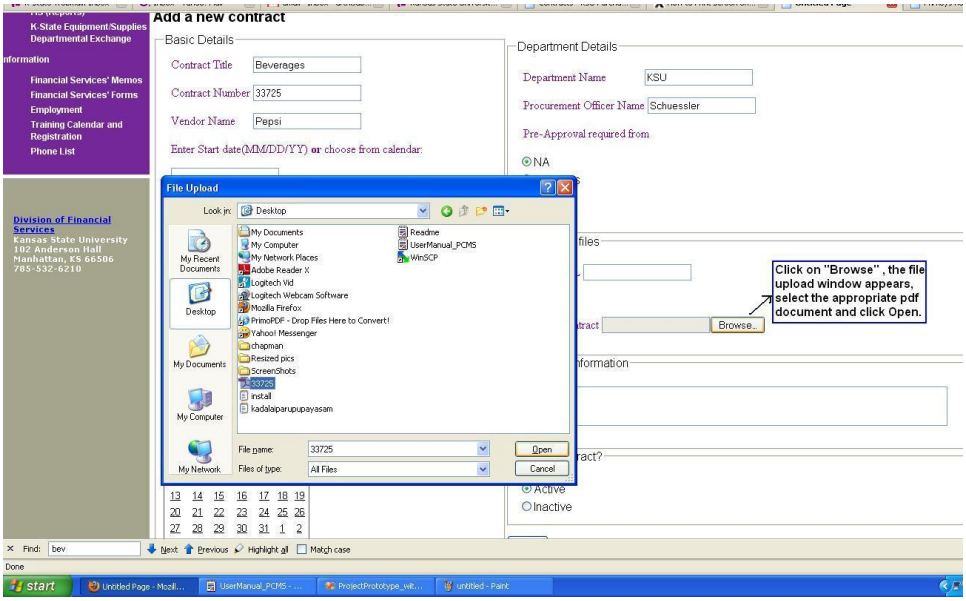
Pre-Approval required from: The 'NA' is selected by default. If the contract requires prior approval from either the Facilities or the HR or the Telecom choose the corresponding radio button. If pre-approval is not required from any of the department choose the 'NA' radio button.

Link to URL OR Upload Contract: Either a link to the Kansas Department of Administration can be provided for the respective contract or if the contract file exists in pdf format it can be uploaded to the system.

Case 1: If a link to the Kansas Department of Administration for a particular contract is present, enter the URL of the Kansas Department of Administration for the respective contract number. For examples: For the contract number 10000 the URL is **http://www.da.ks.gov/purch/contracts/Default.aspx/10000**, hence beside the Link to URL, the value in the text box must be **http://www.da.ks.gov/purch/contracts/Default.aspx/10000**



Case 2: If the contract document exists in pdf format then place the document in your respective computer (Eg: Desktop). Some meta-data can also be set for the pdf document such as the title, author, subject, Keywords. Keywords can be comma separated words. Once this meta-date is set the document is ready to be uploaded to the system. Click the browse button, navigate to the folder were the file is placed when in the File upload window that opens up, choose the respective file and click Open. The text box beside the 'Upload Contract' label now contains the path.

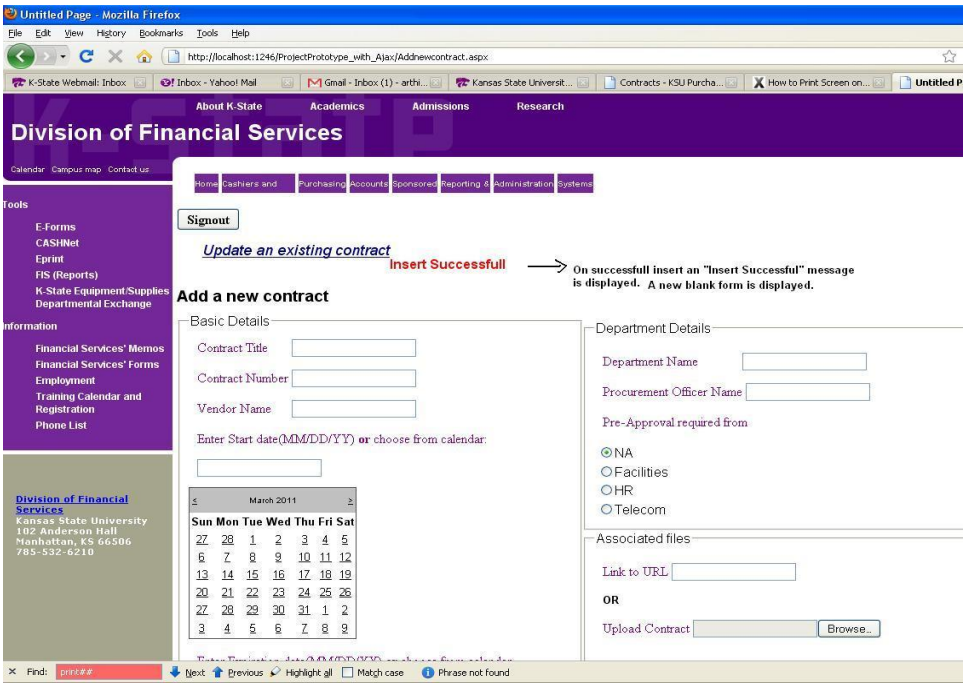


Comments: Comments refer to any additional comments about the contract such as replaces09300. This section will help the user to retrieve the contract details even when he searches for the contract number 09300.

Active/Inactive: Only active contracts are visible to the user when he first looks at the contracts. Hence it is important to make sure the Active radio button is selected. If the contract need not be visible to the user or the contract is expired the status can be set to 'Inactive'.

The Contract Title, Contract Number, Department Name, Vendor Name and Procurement officers name are the mandatory fields. If values are not entered for these fields a '*' appears next to the respective fields. Once the values are entered, on click of the 'Submit' button at the end of the page, the values are inserted in the system.

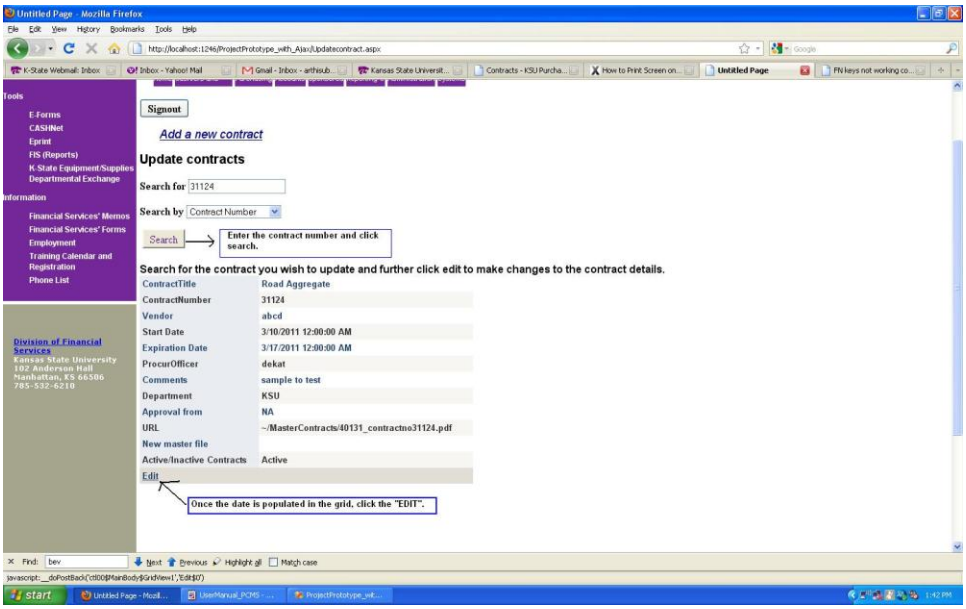
On successful insert, an "Insert Successful" message appears in red on top of the page.



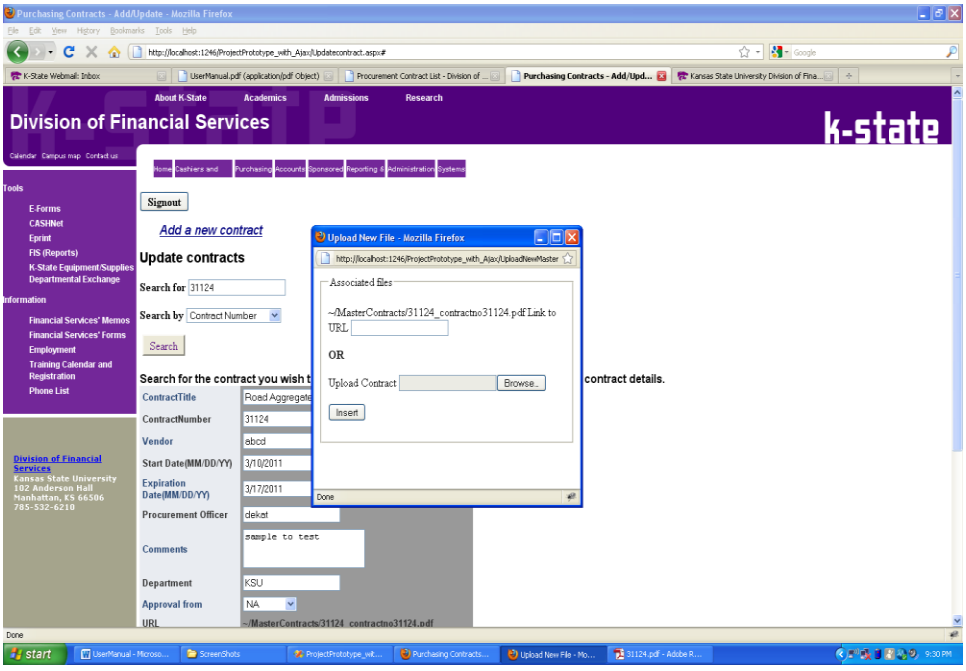
3.1.4. Update Contracts:

The administrator can also edit details of contracts that already exist in the system. In order to ensure that the contract details exist in the system, the administrator first searches for the contract and further updates its details. The basic details of the contract such as the contract number, contract title, vendor name, start date or expiration date can be updated. Other details such as the Department details and/or associated files may also be updated.

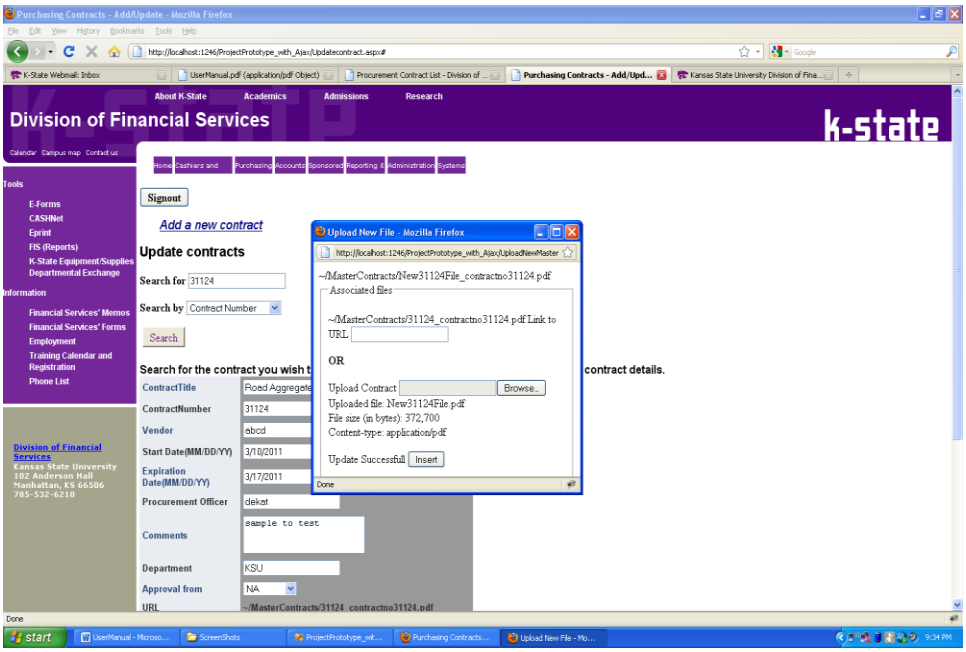
The administrator first enters a search keyword, sets the search filter and clicks the search button. On click of Search the contract details are retrieved from the system. Once the contract details are retrieved the user verifies the information and clicks on the edit link at the end of the page. On click of edit, all the fields in the page become editable. Any changes that need to be made to the contract details such as a change in contract title, change in vendor name etc can be made in this page. Likewise, if the status of contracts must be changed, they can be done so by choosing a different status from the drop-down selection.


Untitled Page - Mozilla Firefox
Signout
Add a new contract
Update contracts
Search for 31124
Search by Contract Number
Search
Enter the contract number and click search.
Search for the contract you wish to update and further click edit to make changes to the contract details.
ContractTitle Road Aggregate
ContractNumber 31124
Vendor abcd
Start Date 3/10/2011 12:00:00 AM
Expiration Date 3/17/2011 12:00:00 AM
ProcurOfficer dekat
Comments sample to test
Department KSU
Approval from NA
URL ~/MasterContracts/40131_contractno31124.pdf
New master file
Active/Inactive Contracts Active
Edit
Once the date is populated in the grid, click the "EDIT".

The following figure represents an update operation being performed on the contract where the "Approval from" field must be changed from NA to Facilities. This can be accomplished by simply changing the value in the drop-down from NA to facilities and clicking on the Update link at the end of the page to save the changes made to the contracts. If however a new master file needs to be uploaded or the new link to the Kansas department of Administration needs to provided, click on the link "Click to upload a new master file" beside the New Master file column.



On click of this link a new window pops up. This window contains a link to the current Master contract file. In addition, the user can either enter a new URL or upload a new contract file. On click of Insert the details of the uploaded contract file are displayed to the administrator and an “Update Successful” message appears.



3.2. User:

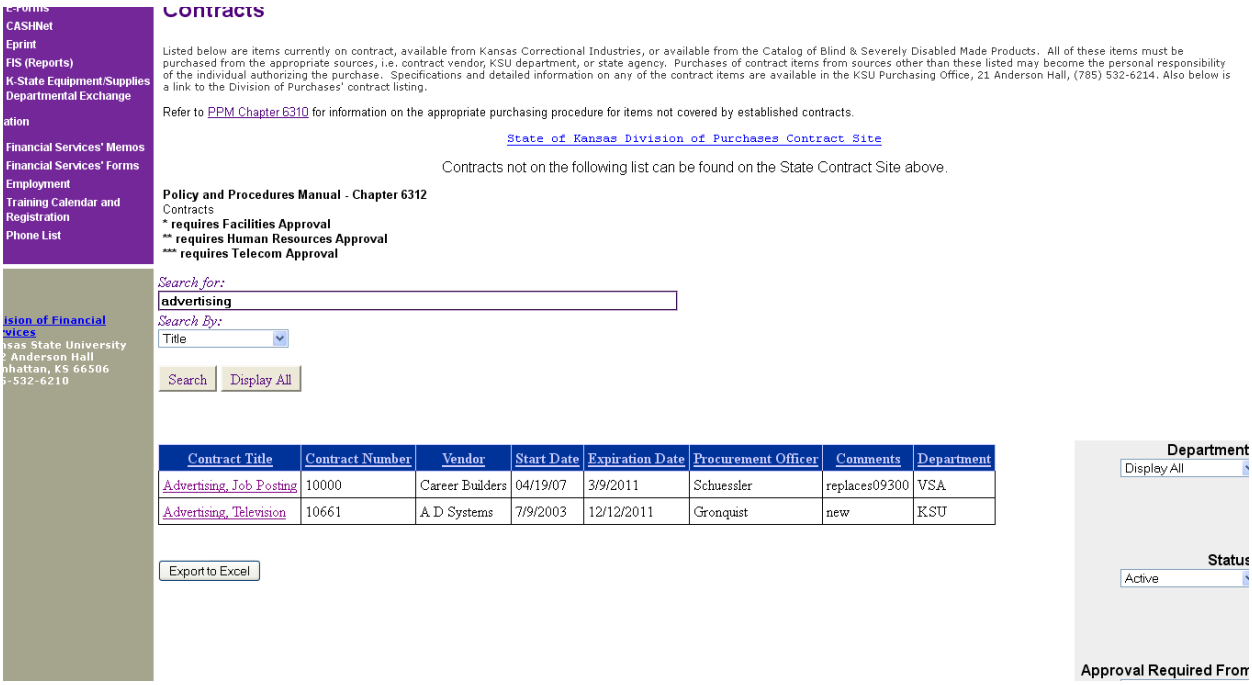
3.2.1. View all contracts:

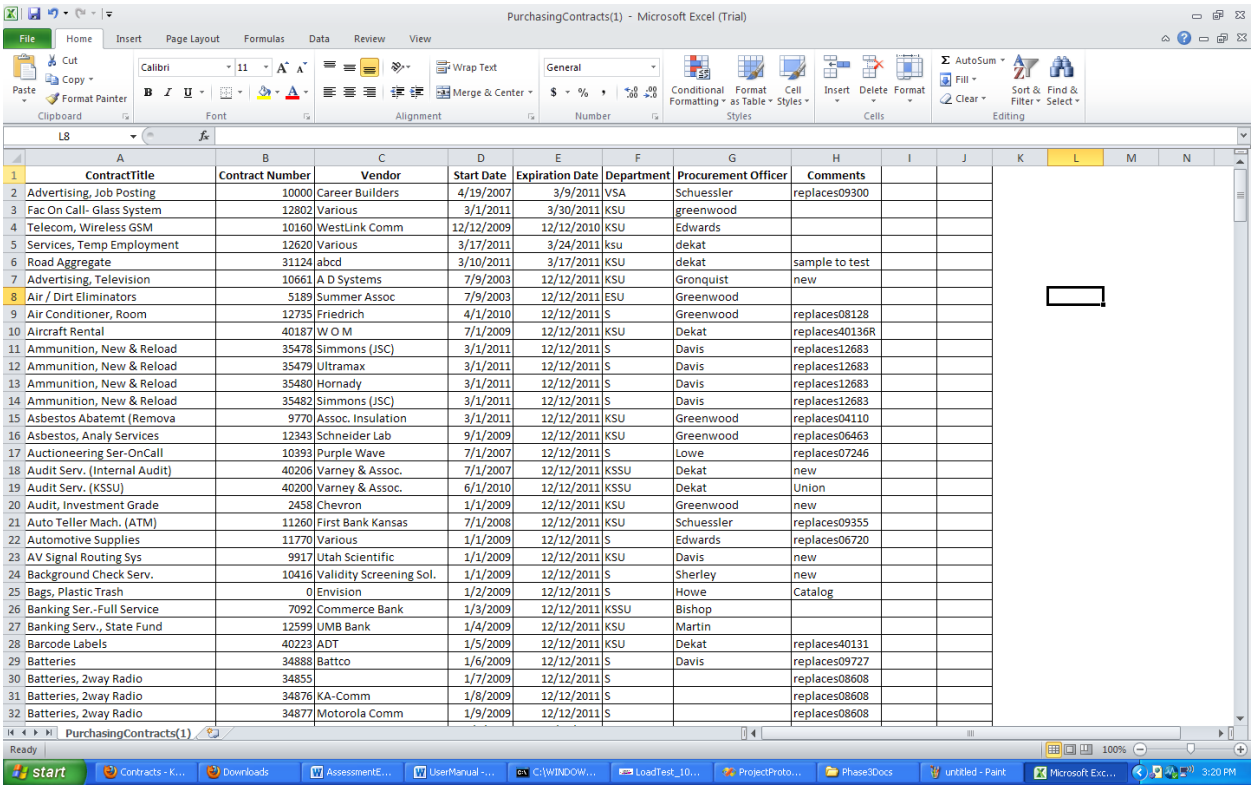
The users of the system are the KSU Departments that view contracts in order to identify the appropriate sources from which items could be purchased i.e contract vendor, KSU department, or state agency. On the click of the “Display All” button the user can view all contracts listed in the system. By default the contracts that are set to the ‘Active’ status are available to the users. However, if the user wishes to look into ‘inactive’ contracts he can do so by setting the ‘Status’ filter in the right side of the page to ‘Inactive’. Other sets of users might be the Facilities, HR or the Telecom departments who might have to know which contracts require their pre-approval. Such information can be found by setting the “Approval required from” filter in the right side of the page to Telecom or HR or Facilities. Once this filter is set to the required department name, the grid on the page containing the contracts are automatically populated with values based on the value of the set criteria. The values populated in the grid can be exported to an excel document by clicking on the ‘Export to Excel’ button at the bottom of the page.

Financial Services' Memos
Financial Services' Forms
Employment
Training Calendar and Registration
Phone List
Contracts not on the following list can be found on the State Contract Site above.
Policy and Procedures Manual - Chapter 6312
Contracts
* requires Facilities Approval
** requires Human Resources Approval
*** requires Telecom Approval
Search for:
Search By:
Contract Number
Search
Display All
Contract Title
Contract Number
Vendor
Start Date
Expiration Date
Department
Procurement Officer
Comments
Advertising, Job Posting 10000 Career Builders 04/19/07 3/9/2011 VSA Schuessler replaces09300
Fac On Call- Glass System * 12802 Various 3/1/2011 3/30/2011 KSU greenwood
Telecom, Wireless GSM *** 10160 WestLink Comm 12/12/2009 12/12/2010 KSU Edwards
Services, Temp Employment ** 12620 Various 3/17/2011 3/24/2011 ksu dekat
Road Aggregate 31124 abcd 3/10/2011 3/17/2011 KSU dekat sample to test
Advertising, Television 10661 A D Systems 7/9/2003 12/12/2011 KSU Gronquist new
Air / Dirt Eliminators 5189 Summer Assoc 7/9/2003 12/12/2011 ESU Greenwood
Air Conditioner, Room 12735 Friedrich 4/1/2010 12/12/2011 S Greenwood replaces08128
Aircraft Rental 40187 W O M 7/1/2009 12/12/2011 KSU Dekat replaces40136R
Ammunition, New & Reload 35478 Simmons (JSC) 3/1/2011 12/12/2011 S Davis replaces12683
Ammunition, New & Reload 35479 Ultramax 3/1/2011 12/12/2011 S Davis replaces12683
Ammunition, New & Reload 35480 Hornady 3/1/2011 12/12/2011 S Davis replaces12683
Department :
Display All
Status:
Active
Approval Required From:
Display All

3.2.2. Search for Contracts:

User can search for contracts based on a contract number, contract title, procurement officer name, vendor name or any other keywords. For example to search by a contract number, the user enters the number in the ‘Search for’ textbox, sets the ‘Search by’ dropdown filter to contract number and clicks on the search button. Once the search button is hit, the grid on the page is populated with the search results retrieved from the database. Partial search keywords can also be entered and contract details can be retrieved. When one of the meta-date is entered in the ‘search for’ textbox and the ‘search by’ filter is set to Keywords, the appropriate contracts are retrieved. Hence contracts can be retrieved based on the value of the contract number, contract title, vendor name, procurement officer name and keywords. Once the grid is populated with the search results, the results can further be filtered by setting the ‘Department’, ‘Status’ and the ‘Approval Required From’ dropdown values.


CASHNet
Eprint
FIS (Reports)
K-State Equipment/Supplies
Departmental Exchange
Financial Services' Memos
Financial Services' Forms
Employment
Training Calendar and Registration
Phone List
Contracts
Listed below are items currently on contract, available from Kansas Correctional Industries, or available from the Catalog of Blind & Severely Disabled Made Products. All of these items must be purchased from the appropriate sources, i.e. contract vendor, KSU department, or state agency. Purchases of contract items from sources other than these listed may become the personal responsibility of the individual authorizing the purchase. Specifications and detailed information on any of the contract items are available in the KSU Purchasing Office, 21 Anderson Hall, (785) 532-6214. Also below is a link to the Division of Purchases' contract listing.
Refer to PPM Chapter 6310 for information on the appropriate purchasing procedure for items not covered by established contracts.
State of Kansas Division of Purchases Contract Site
Contracts not on the following list can be found on the State Contract Site above.
Policy and Procedures Manual - Chapter 6312
Contracts
* requires Facilities Approval
** requires Human Resources Approval
*** requires Telecom Approval
Search for:
advertising
Search By:
Title
Search
Display All
Contract Title
Contract Number
Vendor
Start Date
Expiration Date
Procurement Officer
Comments
Department
Advertising, Job Posting
10000
Career Builders
04/19/07
3/9/2011
Schuessler
replaces09300
VSA
Advertising, Television
10661
A D Systems
7/9/2003
12/12/2011
Gronquist
new
KSU
Export to Excel
Department
Display All
Status
Active
Approval Required From


PurchasingContracts(1) - Microsoft Excel (Trial)
ContractTitle
Contract Number
Vendor
Start Date
Expiration Date
Department
Procurement Officer
Comments
Advertising, Job Posting 10000 Career Builders 4/19/2007 3/9/2011 VSA Schuessler replaces09300
Fac On Call- Glass System 12802 Various 3/1/2011 3/30/2011 KSU greenwood
Telecom, Wireless GSM 10160 WestLink Comm 12/12/2009 12/12/2010 KSU Edwards
Services, Temp Employment 12620 Various 3/17/2011 3/24/2011 ksu dekat
Road Aggregate 31124 abcd 3/10/2011 3/17/2011 KSU dekat sample to test
Advertising, Television 10661 A D Systems 7/9/2003 12/12/2011 KSU Gronquist new
Air / Dirt Eliminators 5189 Summer Assoc 7/9/2003 12/12/2011 ESU Greenwood
Air Conditioner, Room 12735 Friedrich 4/1/2010 12/12/2011 S Greenwood replaces08128
Aircraft Rental 40187 W O M 7/1/2009 12/12/2011 KSU Dekat replaces40136R
Ammunition, New & Reload 35478 Simmons (JSC) 3/1/2011 12/12/2011 S Davis replaces12683
Ammunition, New & Reload 35479 Ultramax 3/1/2011 12/12/2011 S Davis replaces12683
Ammunition, New & Reload 35480 Hornady 3/1/2011 12/12/2011 S Davis replaces12683
Ammunition, New & Reload 35482 Simmons (JSC) 3/1/2011 12/12/2011 S Davis replaces12683
Asbestos Abatemt (Remova 9770 Assoc. Insulation 3/1/2011 12/12/2011 KSU Greenwood replaces04110
Asbestos, Analy Services 12343 Schneider Lab 9/1/2009 12/12/2011 KSU Greenwood replaces06463
Auctioneering Ser-OnCall 10393 Purple Wave 7/1/2007 12/12/2011 S Lowe replaces07246
Audit Serv. (Internal Audit) 40206 Varney & Assoc. 7/1/2007 12/12/2011 KSSU Dekat new
Audit Serv. (KSSU) 40200 Varney & Assoc. 6/1/2010 12/12/2011 KSSU Dekat Union
Audit, Investment Grade 2458 Chevron 1/1/2009 12/12/2011 KSU Greenwood new
Auto Teller Mach. (ATM) 11260 First Bank Kansas 7/1/2008 12/12/2011 KSU Schuessler replaces09355
Automotive Supplies 11770 Various 1/1/2009 12/12/2011 S Edwards replaces06720
AV Signal Routing Sys 9917 Utah Scientific 1/1/2009 12/12/2011 KSU Davis new
Background Check Serv. 10416 Validity Screening Sol. 1/1/2009 12/12/2011 S Sherley new
Bags, Plastic Trash 0 Envision 1/2/2009 12/12/2011 S Howe Catalog
Banking Ser.-Full Service 7092 Commerce Bank 1/3/2009 12/12/2011 KSSU Bishop
Banking Serv., State Fund 12599 UMB Bank 1/4/2009 12/12/2011 KSU Martin
Barcode Labels 40223 ADT 1/5/2009 12/12/2011 KSU Dekat replaces40131
Batteries 34888 Battco 1/6/2009 12/12/2011 S Davis replaces09727
Batteries, 2way Radio 34855 1/7/2009 12/12/2011 S replaces08608
Batteries, 2way Radio 34876 KA-Comm 1/8/2009 12/12/2011 S replaces08608
Batteries, 2way Radio 34877 Motorola Comm 1/9/2009 12/12/2011 S replaces08608
PurchasingContracts(1)
Ready
start

The values populated in the grid can be exported to an excel document by clicking on the 'Export to Excel' button below the grid. The user is now given an option to Open the excel document or Save it. To open the document click Open radio button and select Ok. The contract

details now open in an Excel document. If the user wishes to save the details, he can choose the Save file option and click Ok. The excel document is saved in the Documents folder of the user's computer.

Chapter 10 – Project Evaluation

1. Introduction

This document presents the summary of experiences gained during the entire lifecycle of the developer's MSE project.

2. Problems Encountered

This section describes the problems and difficulties encountered during the project.

2.1. Identification of technology to be used:

One of the foremost problems was identifying which technology to use to develop the system. Although LAMP was one of the technologies considered for implementation, the Division of Financial Services for who the project was implemented preferred .NET technology to be used as a lot of their applications are currently set up in .NET platform.

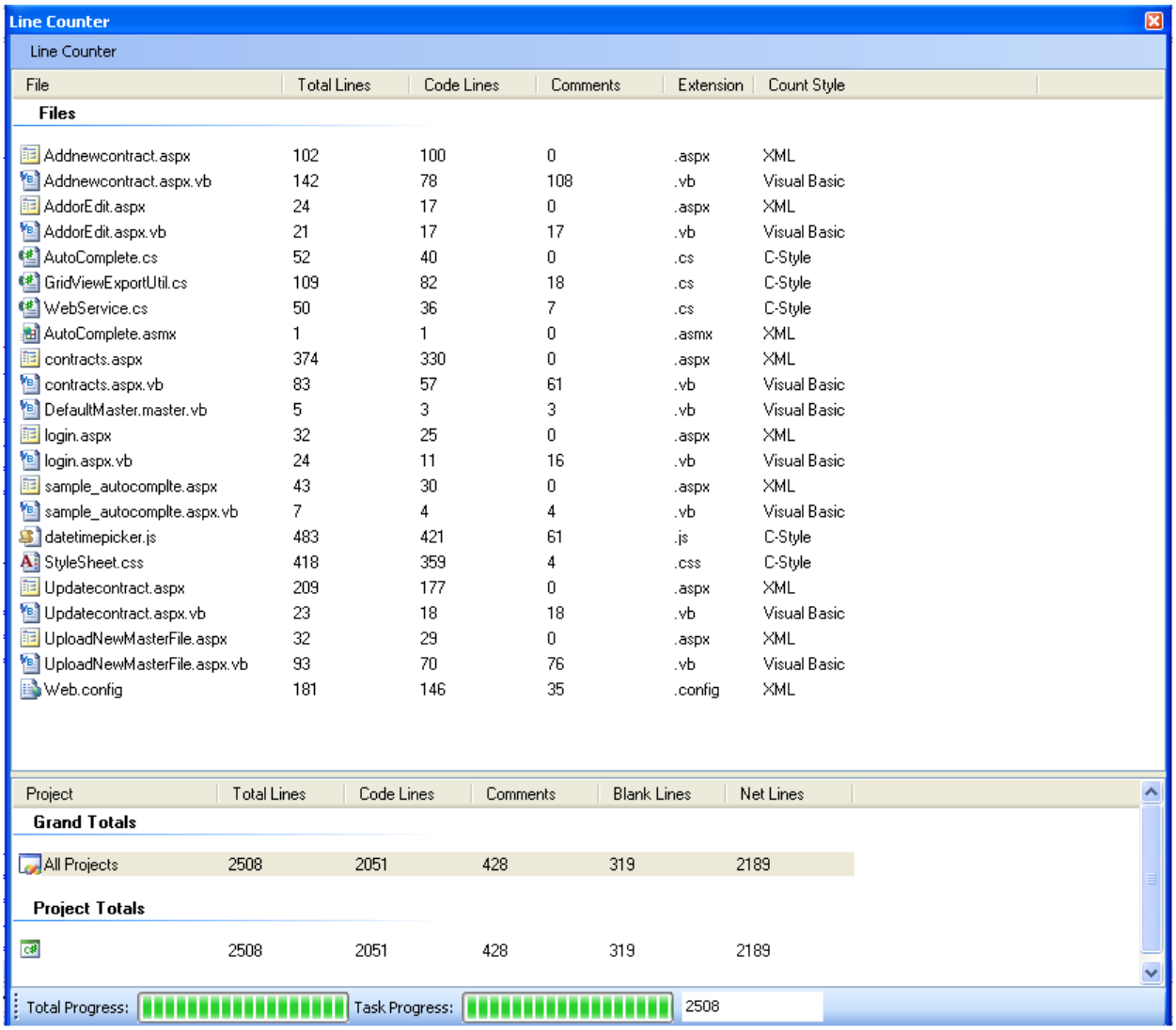
2.2. Features to implement:

Once the basic outline of the project was implemented, new features that could be implemented were constantly discussed with the clients. Since the administrators of the system was the procurement officer and not technical people an effort had to be made to ensure that the features implemented should not complicate the system and make it difficult for them to use, but at the same time implement features that focused on usability as its primary motive.

3. Source Lines of Code

The initial estimate was 2200 SLOC in Phase II based on the current progress of the developer driven from the prototype made in Phase II. The actual SLOC is 2189 which is very close to the predicted SLOC.

Below is the estimate of the Visual Basic Line Counter tool. As observed from the following screen shot, the net SLOC is 2189.


Line Counter
Line Counter
File
Total Lines
Code Lines
Comments
Extension
Count Style
Files
Addnewcontract.aspx 102 100 0 .aspx XML
Addnewcontract.aspx.vb 142 78 108 .vb Visual Basic
AddorEdit.aspx 24 17 0 .aspx XML
AddorEdit.aspx.vb 21 17 17 .vb Visual Basic
AutoComplete.cs 52 40 0 .cs C-Style
GridViewExportUtil.cs 109 82 18 .cs C-Style
WebService.cs 50 36 7 .cs C-Style
AutoComplete.asmx 1 1 0 .asmx XML
contracts.aspx 374 330 0 .aspx XML
contracts.aspx.vb 83 57 61 .vb Visual Basic
DefaultMaster.master.vb 5 3 3 .vb Visual Basic
login.aspx 32 25 0 .aspx XML
login.aspx.vb 24 11 16 .vb Visual Basic
sample_autocomplte.aspx 43 30 0 .aspx XML
sample_autocomplte.aspx.vb 7 4 4 .vb Visual Basic
datetimepicker.js 483 421 61 .js C-Style
StyleSheet.css 418 359 4 .css C-Style
Updatecontract.aspx 209 177 0 .aspx XML
Updatecontract.aspx.vb 23 18 18 .vb Visual Basic
UploadNewMasterFile.aspx 32 29 0 .aspx XML
UploadNewMasterFile.aspx.vb 93 70 76 .vb Visual Basic
Web.config 181 146 35 .config XML
Project
Total Lines
Code Lines
Comments
Blank Lines
Net Lines
Grand Totals
All Projects 2508 2051 428 319 2189
Project Totals
2508 2051 428 319 2189
Total Progress:
Task Progress:
2508

4. Project Duration

The initial estimated time for the COCOMO model analysis of the project was 3.5 months. After the completion of the second phase of the project, the number of days estimated for coding/debugging, testing and documentation was 40 days. The actual time spent on the entire project is about 4.5 months which is approximately 1 month more than the estimate I had made in phase 1. This is because I was unsure about the various additional features that need to be implemented in the system. After a meeting with the stakeholders of the system during phase 2, I was able to make a very close estimate of the time it would require for coding since I had a much clearer idea about the features to be included in the system by the end of phase 3.

The following table shows the entire duration of the project:

	Start Date	Completion Date
Phase 1	Aug 17, 2010	Oct 13, 2010
Phase 2	Nov 10, 2010	Dec 21, 2010
Phase 3	Mar 1, 2011	Apr 22, 2011

Table 9 : Project Duration

The following pie chart shows the breakdown on how much time was spent on each phase:

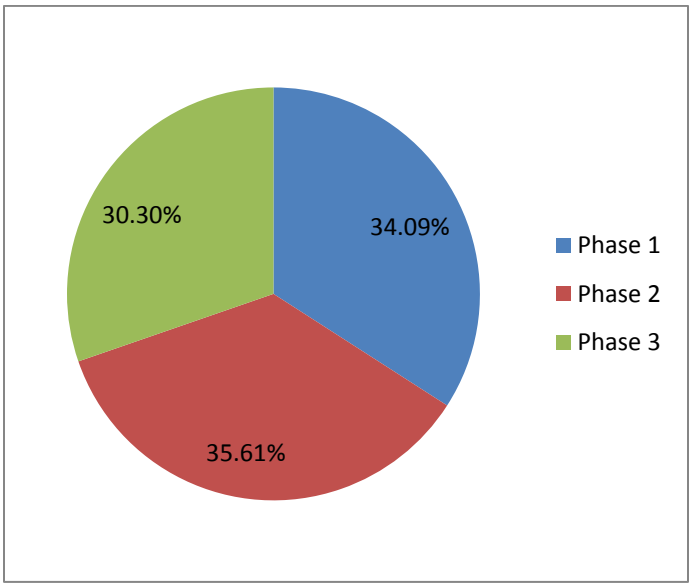


Figure 25 : Breakdown of each phase

The following pie chart shows the breakdown on how much time was spent on Phase I.

It may be observed that almost 65% of the total time was spent on coding and documentation. The documentation in phase 1 included the development of the vision document, project plan and software quality assurance. Although a very basic prototype was developed as part of coding on phase 1, getting accustomed to the .NET platform and technology occupied time.

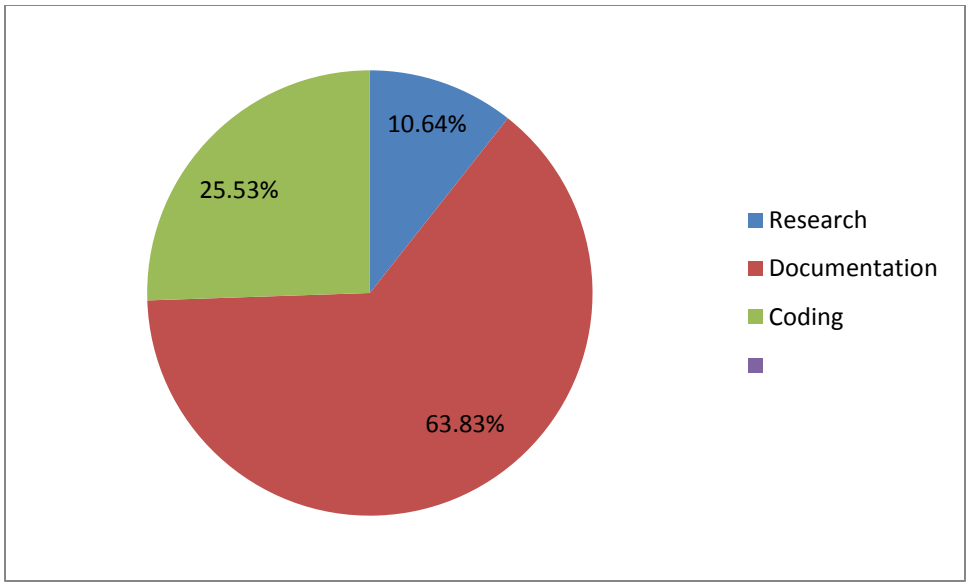


Figure 26 : Phase I breakdown

The following pie chart shows the breakdown on how much time was spent on Phase II.

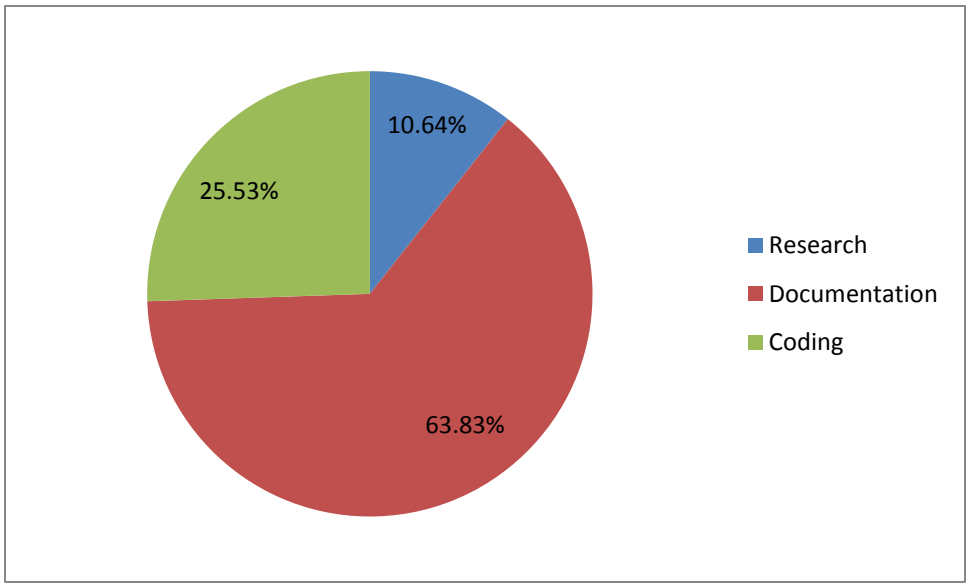


Figure 27 : Phase II breakdown

The following pie chart shows the breakdown on how much time was spent on Phase III:

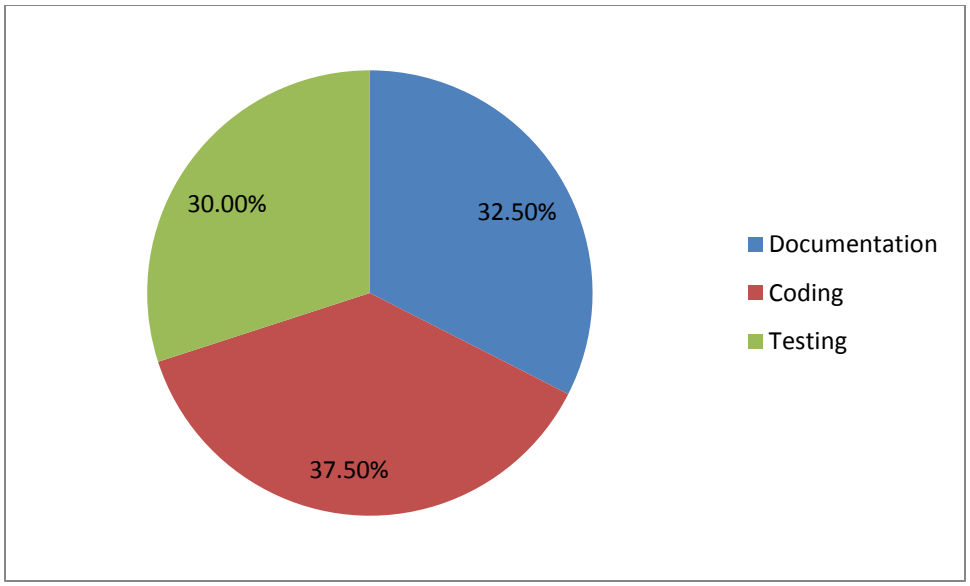


Figure 28 : Phase III breakdown

5. Lessons Learned:

This project has been one of the most rewarding experiences during my Master's program. It gave me good exposure to what it is like to work in a real-world project. Since the project is intended for the division of financial services, I had the opportunity to interact with real clients and hence had a clear understanding of the importance of the stakeholder meetings for requirements gathering. I was able to understand and appreciate the importance of planning the course of a project and in turn to keep up with the time constraints. Going through every phase of the software development life cycle helped me understand the usefulness of documentation. Writing formal specifications focusing on 'what the system should do' helped me later evaluate how the design of the system is correct with respect to the specification and ensure all the features of the system are correctly evaluated.

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